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ERRATA

Page ii. line 2 from bottom for f*u*lcata read f*a*lcata.

,, ii. ,, 3 and 4 for *Sarkidiornis melanotus* read *Tadorna tadorna* and vice versa.

,, 98, ,, 21 for Leucocera read Leucocer*c*a.

,, 102, ,, 4 from bottom for Dendron*o*thus, read Dendron*an*thus.

,, 103, ,, 11 for campertris read campe*s*tris.

,, 106, ,, 2 from bottom for coramandus, read cor*o*mandus.

,, 111, ,, 5 for Hypotaenida, read Hypotaenid*ia*.

,, 114, ,, 4 from bottom for Depetro, read Dupet*or*.

,, 162, ,, 15 for Streptopclia, read Streptopo*e*lia.

,, 195, ,, 30 for fulcata, read f*a*lcata.

,, 196, ,, 21 for *Sarkidiornis melanotus*, read *Tadorna tadorna* and vice versa.

,, 297, ,, 20 & 45 for Eumiyas, read Eum*yi*as.

,, 386, ,, 12 from bottom "The Animal he '*saw*' should read "The Animal he '*shot*'.

,, 387, ,, 1 from top for the word '*unknown*' read '*uncommon.*'

Wild Animal Serial

,, 241, line 19 from bottom for the word '*herd*' read '*head*'.

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,, 733. Misc. Note No. XIV Title.
for *Scolopax r. rusticola*, read *Capella nemoricola*, Hodg.

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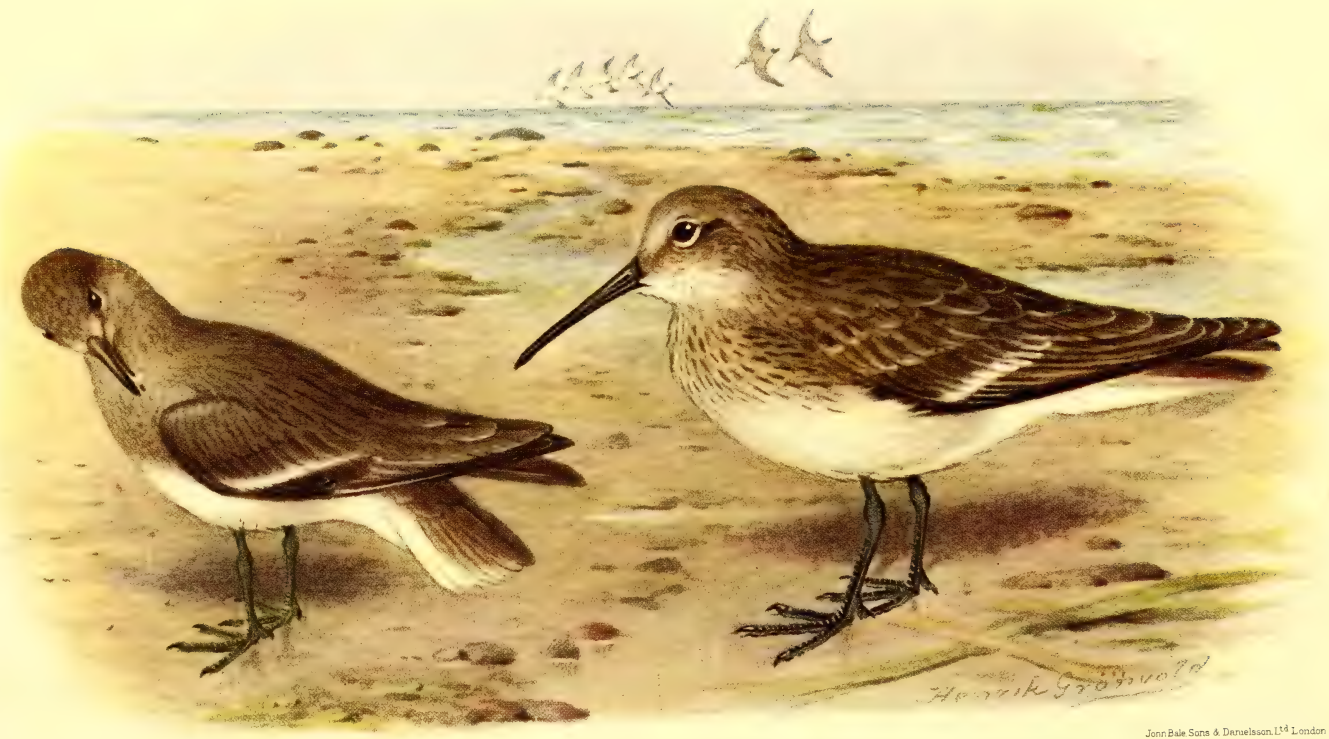
Henrik Grönvold

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TEMMINCKS STINT 3/5.
Erolia temminckii.

THE DUNLIN 3/5.
Erolia alpina alpina.

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THE GAME BIRDS OF THE INDIAN EMPIRE.

BY

E. C. Stuart Baker, C.I.E., O.B.E., F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

Vol. V.

THE WADERS AND OTHER SEMI-SPORTING BIRDS.

Part XXII.

(*With a coloured plate*).

(*Continued from page* 254 *of volume* xxxvii).

Erolia alpina alpina.

The Dunlin.

Tringa alpina Linn., Syst. Nat., 10th ed., vol. i, p. 149 (1758) (Lapland).

Erolia alpina alpina Fauna B.I., Birds, vol. vi, p. 241 (1929).

Description.—Breeding plumage. A narrow line next the bill and a faintly indicated supercilium white, streaked with black; upper plumage bright deep rufous, each feather broadly centred black and some of the longer scapulars and innermost secondaries terminally edged with white; hind-neck greyish-white streaked with black; lower back and rump dark grey-brown, showing little rufous or black; sides of rump and lateral tail-coverts white; central tail-feathers blackish-brown, the lateral grey with white edges; wing-coverts grey-brown with darker centres and pale or whitish edges; the greater coverts with broader white edges; primary coverts and primaries blackish, the former narrowly edged whitish, the latter white-shafted, but the bases and tips of the shafts of the second and third primaries brownish; outer secondaries nearly all white with dark centres; sides of head, chin, throat and upper breast white streaked with blackish, often suffused with rufous, especially on the chin and fore-neck; centre of breast and abdomen blackish-brown; flanks, axillaries and under tail-coverts white, the last streaked with black.

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Colours of soft parts.—Iris hazel or dark brown; bill and legs black.

Measurements.—Wing 104 to 120 mm.; tail 46 to 51 mm.; tarsus about 21 to 26 mm.; culmen 25 to 31 mm.

In Winter.—Upper plumage ashy-grey, the feathers of the head with darker brown streaks, the remainder with dark shaft-stripes only; innermost secondaries darker and browner with narrow whitish or rufescent-white edges; lores, sides of the head, neck and fore-neck fulvescent-grey with dark brown streaks, remainder of lower plumage white.

Young Birds have the upper plumage like the adult in breeding plumage but are much less richly rufous and have more white edges to the feathers of the mantle, the fore-neck is dull pale rufous and the underparts are white, more or less spotted with brown.

Young in down.—Centre of crown and centre of back deep chestnut surrounded by black; a black line through they eye, becoming chestnut posteriorly; a narrow line on the wings black; a black patch on each side of the europygium and a line across joining the black round the centre of the back, the down ending in little whitish tufts; rest of upper surface rich rufous-buff; below whitish-buff, the chin, throat and breast darker.

Distribution.—Europe, from Lapland to Eastern Russia, but replaced in the south during the breeding season by *E. a. schinzii.* (Northern Asia). In India, it is common during the winter in Sind and the north-west, extending as far south as the Deccan and east to Nepal, Eastern Bengal and Assam, though it is rare east of the United Provinces. All our specimens from India appear to be typical *E. a. alpina* and not the more tawny-headed *schinzii.* I cannot separate *E. a. pusilla*, the supposed Eastern and Indian form, from the typical bird. Within Indian limits this little wader is very common on the coasts of north-western India. Inland it is very much less common, though during migration it occurs on some of the rivers and on some of the larger lakes. In eastern India it is certainly sometimes to be seen on the great tidal rivers running into the Bay of Bengal and I have myself seen them on the Brahmaputra about 700 miles from the sea. On the Megna, Hoogli and Ganges they cannot be said to be rare and I have seen them haunting mud flats in company with other small waders, sometimes singly or in pairs, or, very occasionally, in small flocks. Ticehurst (*Ibis* 1924, p. 111) says that the Dunlin is exceedingly abundant in Karachi harbour and the creeks and mud flats of the coast line, but that he seldom saw it inland, except on the Indus.

Nidification.—The Dunlin breeds over the whole of the northern portions of its summer haunts from the Scandinavian countries to somewhere in central Siberia. We found them breeding on tundras on the shores of the Arctic Ocean in Lapland, where very frequently nesting sites were chosen quite close to the houses of a tiny fishing village. One, indeed, I found within 50 yards of the nearest house. They breed both on the low-lying swamps close to the sea coast and on the wide tundra far inland, and Dr.

Hortling and I were surprised to find birds breeding in swamps almost in the centre of Finland. I do not think they ever breed at any great distance from water and always in swampy ground and in open country. Even in Finland and Lapland, where so many waders breed on the outskirts of forests or even some distance inside them, the Dunlin never seems to choose a site for its nest in any marsh on which trees are growing. The nest itself is a very neat little cup of grass bents, either made from the actual living, growing grass or from bents which have been gathered by the bird for the purpose. This latter is especially the case when, as sometimes occurs, the birds choose a site among the roots of a juniper or creeping birch clump in which to build. Generally the nest is placed in grass, while a very favourite position is the summit of some small hummock in a sea of swamp. Here among the grass and moss on the top, the nest is carefully tucked away and concealed. Another favourite position is in the small patches of short thin grass growing on dry ground in what is otherwise all marsh land. In this, frequently, concealment is very indifferent and I have seen nests in which the eggs were perfectly visible from a distance of some yards. On the other hand, when the bird breeds in thick cover, as it often does, the nest is extremely difficult to find and sometimes even when the bird has risen almost at my feet I have taken some minutes to discover its home.

The eggs are, of course, always four in number and are of the usual rather long peg-top shape, like those of other small waders. They vary very greatly in colour, the majority having the ground of pale yellowish or olive stone and being densely marked with small and large blotches of colour varying from bright reddish brown to deep umber brown. In most eggs the impression given is that of rather greenish eggs, the ground colour almost invariably showing up well and the blotches being most numerous at the larger end and rather scanty elsewhere. The secondary markings are all lavender or rather inky grey but are, as a rule, inconspicuous. Occasionally the blotches at the larger end are much bigger than elsewhere and form indefinite groups, the marks coalescing and running into one another. A few eggs are stippled rather than blotched and in these the stipples are generally numerous all over the egg, a little larger and denser at the big end. The general impression of these eggs is rather bright reddish brown. In a collection of eggs belonging to Dr. Wasenius there are two very beautiful clutches of the Dunlin, one of which is of four eggs, pure pale blue, while in the second clutch the eggs have the same ground with a few faint lavender marks. In Witherby's *Handbook of Birds*, p. 571, Jourdain gives the following measurements for 100 eggs: average 34.3 by 24.4, maxima *38.3* by 25.4 and 35.0 by *25.8*, minima *31.3* by 23.2 and 32.0 by *23.0*. Jourdain also draws attention to the fact that the markings very often show signs of rotary movement in the oviduct. His remarks, it should be noted, refer to both the British form, *schinzii* and to the true *alpina*.

In the more southern portions of the breeding area the Dunlin commences to breed about the middle of May and in very warm seasons a week earlier than this, while in the extreme north I have taken perfectly fresh eggs up to the end of June.

At the same time it is extraordinary in what difficult circumstances these little birds sometimes breed. A few years ago, when on the shores of the Arctic Ocean, I found a nest of this bird containing four hard-set eggs in the first week of June. At the time it was snowing hard, a bitter east wind was blowing and all round the nest were several inches of snow, yet the eggs seemed to be in no way damaged. The little bird sat until I almost touched it and returned to the nest within a minute of my leaving it. As is well-known, the Dunlin often feigns injury or sickness in order to attract intruders from its nest. Recently it has been asserted that this action is merely due to a sudden fright and uncontrolled emotion and, therefore, quite purposeless. I cannot, however, for a moment believe this to be the case. I remember on one occasion Dr. Hortling and I found a Dunlin's nest in very open ground in a swamp. The bird sat on the nest until we were within two or three yards of it, when she flew quickly off. Then, seeing that we had noticed her, she at once fell to the ground, fluttering her wings as if seriously injured. As we approached she dragged herself away fluttering and continued to perform her antics so long as we followed her. However, directly we returned to the nest, she at once got up and flew perfectly soundly back to within a few yards of us, and seeing she had attracted our attention, she again went through her tricks. She repeated her attempts to attract us away three or four times and it was perfectly obvious that she carried them out with the intention of making us leave the nest and her precious eggs. At other times when disturbed from her nest the Dunlin leaps into flight, starting with three or four twists and little zig-zag motions, then mounting high in the air, she clears off altogether.

Both sexes take part in incubation and I think it is very probable that the male bird does the greater part of incubation by day. Certainly of those we got or shot during the day time at least 2 out of 3 were males. According to Evans the period of incubation is 22 days.

General Habits.—In western India, the first Dunlins arrive in the country very early in August and most of these are birds which have bred very early. They are generally in worn breeding dress and are undoubtedly adults and, according to Ticehurst, the younger birds arrive later. In Siam and Bengal I think few birds arrive in India before the end of August and these seem to be indifferently adults in worn breeding plumage and young birds. From these provinces most birds have left by the end of April, very few being seen in the first few days of May. In Sind, however, the majority seem to depart in the second and third week of May. Ticehurst saw a few as late as the 5th June and he remarks 'odd ones over-summer and unlike most waders are in summer dress'. Those, however, which wintered in eastern India left either in winter plumage or had only partially acquired breeding plumage. In their actions and feeding there is little to distinguish Dunlins from other small waders. They may be seen scurrying hither and thither over their feeding ground, generally the coast line or muddy banks of rivers. They feed on the same sort of food, i.e., mollusca, snails, slugs, worms, sand-hoppers and all kinds of insects. They sometimes eat small seeds and various forms of grain, but this is perhaps exceptional. When at rest, the Dunlin sits with its head tucked close into its shoulders but, for the most part, it is constantly running rapidly from one place to another hunting for its food. In winter, its ordinary call note is a prolonged 'wee wee-e-et' and it is said also to have a soft 'purr'. These are the only notes we hear in India. In the breeding season, however, it has a very pretty little trilling love song which it utters fluttering in the air or, very occasionally, when perched on a high post or a bare limb of a tree.

Although its flight is rapid and well sustained, it is usually easy to approach, it cannot be placed among true sporting birds. The only specimen I have ever eaten was very plump and in taste like a dry snipe.

(*The end*).

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY.

BY

THE LATE E. BLATTER, S.J., Ph.D., F.L.S.

PART XXVII.

(*Continued from page* 779 *of volume* xxxvii).

CYPERACEAE.

BY

THE LATE E. BLATTER, S.J., Ph.D., F.L.S., and C. McCANN, F.L.S.

20. CAREX Linn. (Cke. ii, 905).

Species 900.—Cosmopolitan, especially temperate, in marshes.

Cooke gives 3 species: *C. condensata*, *C. mercarensis* and *C. speciosa*. *C. condensata* has to be changed into *C. cruciata* and *C. mercarensis* will be put as var. under *C. Lindleyana*.

We add 9 more species which were not known to Cooke as occurring in the Presidency.

Key:

A. Style 2-fid
  Terminal spike female at base, male at top
    1. Spikes short, ovoid or oblong
      a. Utricle many-nerved on both faces ... 1. *C. nubigena.*
      b. Utricle nerveless on plane face ... 2. *C. foliosa.*
    2. Spikes linear-cylindric, peduncled, inflorescence loose ... ... 3. *C. brunnea.*

B. Style 3-fid
  I. Terminal spike female at base, male at top, or when spikes very numerous, many male at top, terminal spike sometimes wholly male
    1. Spikes short, very numerous
      a. Nut fitting utricle pretty closely, ellipsoid, substipitate, pyramidal at top; style-base scarcely dilated ... 4. *C. cruciata.*
      b. Nut ovate-elliptic. Style-base slightly thickened ... ... 5. *C. filicina.*
      c. Nut ovate, short-stipitate ... 6. *C. Lindleyana.*
    2. Spikes long-cylindric ... ... 7. *C. baccans.*
    3. Not to be placed among a and b ... 8. *C. speciosa.*

  II. Terminal spike wholly male. Spikes not very numerous, occasionally 12. Utricle hairy or minutely setulose ... ...
    1. Glaucous ... ... 9. *C. glauca.*

2. Not glaucous
   a. Rhizome long, creeping, many stolons 10. *C. setigera.*
   b. Rhizome short, stems caespitose ... 11. *C. Halleriana.*
   c. Rhizome creeping, stems caespitose ... 12. *C. breviculmis.*

1. **Carex nubigena** D. Don in Trans. Linn. Soc. xiv (1825) 326; C. B. Clarke in Hook. f. F.B.I. vi, 702.

Description: Stems 15-75 cm., caespitose on a tough perennial rhizome; rhizome short or 0. Leaves long, narrow, incurved when dry. Inflorescence from 1.3 cm., dense, ovoid, to 12.5 cm., linear, interrupted, greenish becoming brown; lowest bract usually much overtopping inflorescence, sometimes not 6 mm. Spikes 5 mm., dense, ovoid, androgynous; male at top forming an ovoid oblong or interrupted linear compound spike. Female glumes ovate, scarcely apiculate, shorter than utricle. Anthers linear-oblong, very shortly apiculate. Style 2-fid, occasionally 3-fid. Utricle small, of thin texture, plano-convex, green or pale brown, 9-11-nerved on plane face, 11-15 on convex; small red glands frequently scattered all over utricle between the nerves; beak not winged, commonly quite smooth, not rarely scabrid, sometimes almost hispid. Nut hardly $\frac{1}{2}$ utricle, compressed, obtuse, brown.

Locality: *Sind*: (Pinwill ex Clarke).

Distribution: Himalaya, 5-13,000 ft., Khasia to Muneypoor, 4-600 ft., Sind. Nilgiris, Anamalais, Pulney Hills, Ceylon, Afghanistan, Malaya, China, Japan.

2. **Carex foliosa** D. Don in Trans. Linn. Soc. xiv (1825) 327.—*C. Wallichiana* Spreng. Syst. iii (1826) 812 (*non* Presc.).—*C. muricata* var. *foliosa* C. B. Clarke in Hook. f. F.B.I. vi, 703.

Description: Rhizome short, woody, caespitose. Stems up to 90 cm., strict, firm, triquetrous, very scabrous above. Leaves shorter or longer, 3-5 mm. broad, flat, sheaths thickened at the mouth, not longer than the base of the lamina; ligule broader than long, with a brown margin. Spikelets numerous, many-flowered, crowded towards the apex, the lower ones remote, compound, often setaceous-bracteate, forming an interrupted, 3-9 cm. long spike. Glumes ovate, acuminate-aristate, pale with a green keel. Utricle much exceeding the glumes, 3.5 mm. long, pale green, glabrous, almost nerveless, ovate or ovate-lanceolate below, narrowed into a slender 2-fid beak, margins scaberulous. Nut oval, filling the utricle. Base of style thickened. Stigmas 2.

Locality: *Sind*: (Pinwill ex Clarke).

Distribution: Himalaya, 6,000-9,000 ft., from Kashmir to Nepal and Sikkim, Khasia, Sind, Nilgiris, Pulney Hills, 6,500-8,000 ft.

3. **Carex brunnea** Thunb. Fl. Japon (1784) 38; C. B. Clarke in Hook. f. F.B.I. vi, 705.—*Ibidem* synonyms.

Description: Rhizome oblique. Stems 30-90 cm., slender. Leaves $\frac{2}{3}$ stem, 4 mm. broad. Cauline sheaths somewhat distant, lowest usually above middle of plant. Inflorescence long, lax. Peduncles often several from each sheath, lowest exsert 2.5-20 cm., slender, nodding, sometimes bearing 3-10 spikes, often 2 or more from one sheath. Spikes 3.8-5 cm., slender. Male glumes obtusely triangular, reddish brown; female glumes ovate, acute or scarcely mucronate, apex triangular, ultimately ferruginous-brown. Utricle rather small, not parallel-sided, 9-15-nerved on each face, minutely hairy on nerves, suddenly narrowed into a beak about half utricle; beak linear, shortly bifid, lobes erect; ripe utricle brown ellipsoid, much flattened, pilose (in Indian examples), striate. Nut much flattened, ovoid, suddenly narrowed at top, yellow-brown, nearly filling utricle except beak. Exsert portion of stigmas about as long as utricle. Style 2-fid, about as long as beak, slightly swollen, contracted at base; branches long, very brown.

Locality: *Sind*: (Pinwill ex Clarke).

Distribution: W. Himalaya, Assam, Burma, Muneypore, Sind, Nilgiris, Anamalais, Pulneys, Tinnevelly Hills.—Ceylon, Mascarene Isles, Mauritius, China, Japan, Korea, Australia, Philippines, Sandwich Islands, Yunnan.

4. **Carex cruciata** Wahlenb. in Vet.-Akad. Handl. Stockholm xxiv (1803) 149; C. B. Clarke in Hook. f. F.B.I. vi, 715.—*C. condensata* Nees in Wight Contr. (1834) 123 (*excl. var.*); C. B. Clarke l.c.

Description: Rhizome woody horizontal, over 15 cm. long. Culms 60-90 cm. tall. Leaves linear acuminate, 30-60 cm. long, 6-13 mm. wide, margins at tip scabrid. Panicles narrow, strict, erect, 5 cm. long, branches short pubescent. Spikelets 2.5-6 mm. long; flowers few. Glume ovate acuminate or mucronate, keeled. Utricle longer, ovate, yellow, orange, or olive-coloured, ribbed, beak long curved, margins scabrid entire. Nut ovate-elliptic.

Locality: *Sind*: (Pinwill ex Cooke).—*W. Ghats*: Mahableshwar (Dalzell & Gibson ex Cooke).—Not seen by Cooke.

Distribution: Himalaya from Kumaon to Sikkim and Bhutan, Khasia, Tenasserim and Malacca, Central Provinces, Sind.—Tonkin, China, Yunnan, Formosa, Madagascar.

5. **Carex filicina** Nees in Wight Contr. (1834) 126; C. B. Clarke in Hook. f. F.B.I. vi, 717.—*C. nilagirica* Hochst. ex Steud. Synops. *Cypera.* (1855) 207.

Description: Glabrous, except the minutely hairy panicle branches. Rhizome very woody, short (no long stolons). Stems 30-90 cm. Leaves very long, often as long as stems, flat, thin. Inflorescence elongate of distant pyramidal compound panicles. Panicle usually more than half stem; partial panicles often very dense; branches much slenderer than in *C. cruciata* or *condensata.* Spikes small often very many on slender branches not congested. Female glumes commonly small, not (or scarcely) mucronate, ovate, as long as utricle (without beak), sometimes elliptic-lanceolate, glabrous or minutely hairy, chestnut in South Indian form, often paler or ferruginous in the Khasian. Style 3-fid. Utricle 2.5 mm., trigonous, fitting the black nut very closely, about 15-nerved, glabrous, tapering or suddenly narrowed at top; beak oblique, curved, subrecurved or straight, more or less scabrous-hairy, mouth very small, shortly bifid.

Var. **meiogyna** Strachey Cat. Pl. Kumaon (1854) 73.

Description: Glumes smallish, ovate, mostly paler. Utricles broader, beak shorter.

Locality: *Sind*: (Pinwill ex Clarke).

Var. **minor** Boott Illustr. iii (1862) 106, t. 317-18.

Description: Leaves narrower, inflorescence paniculate, depauperate. Utricles shorter. Othrwise like *meiogyna.*

Locality: *Sind*: (Pinwill ex Clarke).

Distribution of species: Nilgiris, Pulneys, throughout the Himalayas, Assam, Burma.—Ceylon, Tonkin, China, Yunnan, Java, Borneo, Sumatra.

6. **Carex Lindleyana** Nees in Wight Contr. (1834) 121; C. B. Clarke in Hook. f. F.B.I. vi, 721.

Var. **major** Fischer in Flora Madras ix (1931) 1687.—*C. mercarensis* Hochst ex Steud. Syn. Pl. Cyper. (1855) 194, var. *major* Steud. l.c.; Cke. ii, 906.

Description: Cke. l.c.

Locality: Without locality (Dalzell !).—*Konkan*: Ambewadi (Patwardhan 1104 !).—*W. Ghats*: Matheran (Herb. St. X.C. C20 ! C21 !, H.E.B.B. !); Mahableshwar (Ezekiel !, Woodrow 79 ex Cooke), Bombay Point (Fernandez C152 !), Fitzgerald Ghat, 3 miles from Mahableshwar (Blatter C154 !, McCann !); Panchgani (Talbot 4475 !, Blatter & Hallberg B1737 !); common (McCann !); Londa (Woodrow ex Cooke); Castle Rock, 1,700 ft., rainfall 200 in. (Herb. Sedgwick & Bell 5552 !, McCann C23 !, Gammie 15765 ! 15887 !).—*S. M. Country*: Belgaum (Hole 23 !).—*N. Kanara*: Arbail Ghat, 2,000 ft., rainfall 200 in. (Sedgwick 3129 !); Anmod, forest, 2,000 ft., rainfall 200 in. (Sedgwick 3453 !); Devimane Ghat (Hallberg & McCann C24 !); Kilkund (Talbot 3531 !); Yellapur (Talbot 667 !); Jugglepet (Talbot 1564 !); Armhi Ghat (Talbot 1321 !); Guddehulli peak, Karwar (Bell 7737 !).

Flowering & fruiting: March 1918 (Matheran); March 1919 (Castle Rock); March 17th 1917 (Mahableshwar); September 21st 1883 (Yellapur); September 25th 1884 (Yellapur); October 1920 (Panchgani); October 10th 1885 (Armhi Ghat); October 11th 1928 (Mahableshwar); October 28th 1902 (Castle Rock);

October 29th (Panchgani); November 1910 (Kanara District); November 1917 (Arbail Ghat); November 1929 (Fitzgerald Ghat); November 14th 1885 (Jugglepet); December 1917 (Anmod); December 1920 (Guddehulli); December 1st 1895 (Nilkund); December 12th 1896 (Matheran).

Field notes: A monsoon species in deciduous forest, but it lasts longer in evergreens, practically throughout the year. The flowering commences about the middle of September.

A weak looking sedge growing in tufts under the shade of trees. The rhizomes are black and woody. They persist for years.

Distribution: Deccan, S. M. Country, N. Kanara, Mercara, Attapadi, Anamalais, Pulney Hills, High Wavy Mountain, 5,000-8,000 ft.

7. **Carex baccans** Nees in Wight Contr. (1834) 122; C. B. Clarke in Hook. f. F.B.I. vi, 722.

Description: Robust, glabrous. Rhizome very stout, short, horizontal, with approximate stems. Stems often 0.9 m. Leaves often overtopping inflorescence, 8 mm. broad. Inflorescence 30-45 by 7.5-10 cm. (small examples occur); bracts much overtopping inflorescence; lowest peduncle usually distant, exsert; partial panicle often 5-12.5 by 2.5-5 cm. Spikes 3.8 by 0.6 cm., male portion dark red when young. Female glumes ovate or obovate, acute or obtuse, often cuspidate sometimes (even in large examples) muticous. Utricle in the fully developed state 2.5 mm. diameter, nearly globose, wall thickened more or less succulent, red, nearly glabrous rarely obscurely scabrous-hairy near top; utricles in the half-ripe state usually olivaceous with more prominent recurved beak. Nut ellipsoid-trigonous, pyramidal at both ends, black, much narrower than utricle; style-base linear.

Locality: Without locality (Dalzell !).—*W. Ghats*: Mahableshwar (Herb. Sedgwick & Bell 7285 !, Blatter 1594 !).

Flowering & fruiting: November 1919 (Mahableshwar); November 1929 (Mahableshwar).

Distribution: Nepal, Sikkim, Khasia and Naga Hills, Upper Burma, Ganjam District, W. Ghats of Madras Presidency, 3,000-7,000 ft., Mysore.—Ceylon, Cochin-China, Malay Archipelago, Philippines, Formosa, South China.

8. **Carex speciosa** Kunth Enum. ii (1837) 504; Cke. ii, 906.—For synonyms see C. B. Clarke in Hook. f. F.B.I. vi, 729.

Description: Cke. l.c.

Locality: *N. Kanara*: Hulgi, in mixed forest (Talbot 3142 !, 2 sheets, Talbot 2282 ex Cooke).

Flowering & fruiting: April 20th and 28th 1894 (Hulgi).

Distribution: Throughout India.—Tonkin, Borneo.

9. **Carex glauca** Murr. Prodr, Stirp. Gotting. (1770) 76; Kükenth. in Engler's Pflanzenr. iv, 20 (1909) 416.—*C. flacca* Schreb. Spic. Fl. Lips. Append. (1771) 669.

Description: Rhizome producing long stolons. Culm 20-45 cm. high, rigid, obsoletely triquetrous, smooth, leafy below. Leaves shorter than the culm, 2-4 mm. broad, with the margins revolute, keeled, glaucous, patent, the lower sheaths brown-purple. Spikelets 4-5, the upper 2-3 (rarely 1) male, cylindrical, the lower 2-3 female (at the apex often male), thinly cylindrical, 2-3 cm. long, dense-flowered, more or less pedunculate, erect or finally pendulous, peduncles setaceous, scabrous. Bracts foliaceous, the lowest often exceeding the inflorescence, sometimes shortly sheathing. Female glumes ovate or oblong-ovate, slightly acute, black-brown, often very shortly mucronate. Utricles slightly exceeding the glumes, finally membranous, ovate-ellipsoid or subobovate, subinflated trigonous, 3 mm. long, straw-coloured-greenish, nerveless except 2 marginal nerves, truncate at base, on the margins above sometimes sparingly scabrous, beak very short, truncate, often curved outwardly. Nut obovate, trigonous. Stigmas 3.

Var. **cuspidata** (Host.) Aschers. *et* Graebner Synops. Mitteleurop. Fl. ii, 2 (1902-03) 138.—*C. cuspidata* Host. Gram. Austr. i (1801) 71, t. 97.—*C. flacca* C. B. Clarke in Hook. f. F.B.I. vi, 742.

Description: Female spikelets slender, pedunculate, erect. Male glumes narrowed, female mucronate or aristate. Utricles shorter than the glumes, ellipsoid, olivaceous, acute at apex.
Locality: *Sind*: (Pinwill ex Clarke).
Distribution of var.: Mediterranean, North Africa, Western Asia, Orient, Sind.

10. **Carex setigera** D. Don in Trans. Linn. Soc. xiv (1824) 330; C. B. Clarke in Hook. f. F.B.I. vi, 743.
Decsription: Glabrous, stoloniferous. Rhizome long, creeping, 2.5 mm. diameter. Stems 30-60 cm. Leaves nearly as long as stem, 3-4 mm. broad. Spikes 4-8, 3.8-5 cm. long, cylindric, distant, terminal 1 (or 2-3) male, lowest female, peduncled erect, female up to 8 mm. broad; spike often male at top, rather lax, often interrupted at base. Female glumes as long as utricle, with a bristle much overtopping utricle in the standard form (which is often small or disappears) usually with bright brown sides and scarious margins (but the colour of male and female glumes varies widely). Utricles 2-5.2 mm.; ovoid, hispid, suddenly narrowed into small oblong notched beak, brown-green, very hispid, nerveless, strongly 2-edged, the concave face only obscurely ridged by the angle of nut, margined by the incurved edges. Nut ellipsoid, trigonous, narrowed much at base, dark brown; style slender, glabrous, 3-fid, base not dilated; exsert part of branches about as long as utricle.

Var. **Schlagintweitiana** (Boeck) Kükenth. in Engl. Pflanzenr. iv, 20 (1909) 419.—*C. Schlagintweitiana* Boeck. Cyp. Nov. i (1888) 48; C. B. Clarke l.c.
Description: Leaves narrower. Spikelets narrower, often shorter. Female glumes mostly only mucronate. Utricles small, with a shorter beak.
Locality: *Sind*: (Pinwill ex Clarke).
Distribution of var.: Yarkand, W. Himalaya, Yunnan, Sind.

11. **Carex Halleriana** Asso Synops. Stirp. Arag. (1779) 133. t. 9, fig. 2; C. B. Clarke in Hook. f. F.B.I. vi, 745.—*Ibidem* synonyms.
Description: Rhizome stout, densely caespitose, many-branched. Culm 10-40 cm. high, weak, obsoletely triquetrous, upwards scabrous. Leaves shorter than the culm, 1.5-2.5 mm. broad, with the margins revolute, scabrous above, bright green, subrigid, lower sheaths brown. Spikelets 3-6, the terminal one male, linear-oblong, 1-1.5 cm. long, sessile or shortly pedunculate, lateral ones 2-5 female (at the apex often male), ovate, few and subdensely flowered, 8-10 mm. long, the upper 1-3 spikelets male, approximate, subsessile, the lower 1-2 very long—unequally pedunculate, capillary peduncles decumbent, sparsely scabrous. Bracts scale-like, amplexicaul, the lowest shortly setaceous. Female glumes lanceolate ovate, muticous or mucronate, chestnut or copper-coloured, the margins white-hyaline, on the back greenish 3-nerved. Utricles longer than the glumes, finally obliquely patent, membranous, obovate-oblong, trigonous, 4-5 mm. long, brownish green, minutely and sparsely pubescent, many-costate, long-attenuate into a winged stalk. Nut tightly enclosed oblong-obovate, stipitate; base of style thickened. Stigmas 3.
Locality: *Sind*: (Pinwill ex Clarke).
Distribution: Mediterranean, Europe, N. Africa, W. Asia, Orient, Sind.

12. **Carex breviculmis** R. Br. Prodr. Nov. Holl. (1810) 242; C. B. Clarke in Hook. f. F.B.I. vi, 746.—*C. Royleana* Nees ex Wight Contr. (1834) 127.
Description: Slender, glabrous, except utricles. Rhizome creeping. Stems caespitose, 10-40 cm. Leaves often $\frac{2}{3}$ stem, 3 mm. broad, flat. Spikes 2-5, oblong, rather small, usually approximate, subsessile; terminal one male pale, lowest female sometimes 15 cm. distant on 5 cm. peduncle, with 8-14 utricles. Female ripe spikes 8 by 4 mm. Female glumes with long bristle much exceeding utricles. Style 3-fid, at base dilated green, sometimes forming a button as in the nuts of *Eleocharis*. Utricle small, ellipsoid, trigonous, slightly hairy, tip pyramidal.
Locality: *Sind*: (Pinwill ex Clarke).
Distribution: N.-W. Himalaya, Assam, Khasia Hills, Nilgiris, Pulneys.—Tonkin, China, Japan, Formosa, Korea, Australia, New Zealand.

THE CYPERACEAE IN COOKE AND THE PRESENT PAPER.

	Sp. in Cooke.	Sp. in this paper.	
1. *Kyllinga*	2	5	
2. *Pycreus*	9*	10	*under *Cyperus*.
3. *Juncellus*	3*	3	*under *Cyperus*.
4. *Cyperus*	27	35	
5. *Mariscus*	5*	6	*under *Cyperus*.
6. *Courtoisia*	1	1	
7. *Eleocharis*	7	8	
8. *Fimbristylis*	17	18	
9. *Bulbostylis*	1	3	
10. *Scirpus*	11	13	
11. *Eriophorum*	1	1	
12. *Fuirena*	4	4	
13. *Lipocarpha*	...	2	
14. *Rhyncospora*	3	2	
15. *Schoenus*	...	1	
16. *Remirea*	1	1	
17. *Hypolytrum*	1	1	
18. *Scleria*	6	8	
19. *Diplacrum*	...	1	
20. *Carex*	3	12	
Total ...	102	135	

We have combined *Cyperus tegetiformis* and *C. tegetum* with *C. corymbosus* Rottb.; *C. tuberosus* with *C. rotundus; Scirpus Michelianus* with *Juncellus pygmaeus;* and *Scirpus Kysoor* with *S. grossus.*

We have excluded from the Bombay Flora *Rhyncospora Wallichiana.*

DISTRIBUTION OF GENERA IN THE PRESIDENCY.

	No. of species in the Presy.	Sind.	Cutch.	Kathiawar.	Gujerat.	Khandesh.	Deccan.	Konkan.	W. Ghats.	S.M. Country.	N. Kanara.
1. *Kyllinga* ...	5	1	...	...	1	...	2	4	5	4	4
2. *Pycreus* ...	10	3	1	...	3	1	5	8	9	6	8
3. *Juncellus* ...	3	2	1	1	3	2	3	3	1	3	2
4. *Cyperus* ...	35	17	9	1	16	5	13	21	17	18	22
5. *Mariscus* ...	6	1	...	...	...	...	1	3	5	3	3
6. *Courtoisia* ...	1	...	...	...	...	...	...	1	...	1	1
7. *Eleocharis* ...	8	4	...	...	3	1	1	5	4	5	6
8. *Fimbristylis* ...	18	10	1	1	12	4	9	15	12	15	16
9. *Bulbostylis* ...	3	1	...	...	1	...	1	...	1	2	3
10. *Scirpus* ...	13	10	2	1	8	2	4	6	5	5	8
11. *Eriophorum* ...	1	1	...	...	1	1	1	...	...	...	...
12. *Fuirena* ...	4	...	...	1	1	1	2	1	3	2	3
13. *Lipocarpha* ...	2	...	...	...	...	...	...	...	1	1	2
14. *Rhyncospora* ...	2	...	..	...	...	...	1	1	2	1	2
15. *Schoenus* ...	1	1	...	...	...	...	...	...	...	...	...
16. *Remirea* ...	1	...	...	...	...	...	...	...	...	...	1
17. *Hypolytrum* ...	1	...	...	...	...	...	...	...	1	...	1
18. *Scleria* ...	8	...	...	...	1	...	1	5	3	2	7
19. *Diplacrum* ...	1	...	...	..	...	...	...	...	...	...	1
20. *Carex* ...	12	9	...	...	...	...	...	1	3	1	2
Total ...	135	60	14	5	50	17	44	74	72	69	92

DISTRIBUTION OF SPECIES IN THE PRESIDENCY.

———	Sind.	Cutch.	Kathiawar.	Gujerat.	Khandesh.	Deccan.	Konkan.	W. Ghats.	S. M. Country.	N. Kanara.	
KYLLINGA											
1. *triceps* ...	*	...	...	*	...	*	*	*	*	...	Conctd. in the Deccan.
2. *melanosperma* ...	...	...	...	...	...	...	...	*	*	*	
3. *squamulata* ...	...	...	...	...	...	...	*	*	...	*	
4. *brevifolia* ...	...	...	...	...	...	*	*	*	*	*	
5. *monocephala* ...	...	...	...	...	...	...	*	*	*	*	Conctd. in the Konkan.
Total ...	1	...	...	1	...	2	4	5	4	4	
PYCREUS											
1. *flavescens* ...	...	...	...	...	...	*	...	*	...	*	
2. *latespicatus* ...	...	...	...	...	...	*	*	*	*	*	Conctd. in the Deccan.
3. *malabaricus* ...	...	...	...	...	...	...	...	*	...	*	
4. *sanguinolentus* ...	*	...	...	...	...	*	*	*	*	*	Conctd. in the Deccan.
5. *puncticulatus* ...	...	...	...	...	...	...	*	*	...	...	
6. *albomarginatus* ...	...	...	...	...	...	...	*	*	*	*	Conctd. in the Konkan.
7. *globosus* ...	...	...	...	*	*	*	*	*	*	*	Conctd. in the Deccan.
8. *odoratus* ...	*	*	...	*	...	...	*	*	*	*	Conctd. in N. Kanara.
9. *hyalinus* ...	...	...	...	...	...	...	*	...	...	...	
10. *pumilus* ...	*	...	...	*	...	*	*	*	*	*	
Total ...	...	1	...	3	1	5	8	9	6	8	
JUNCELLUS											
1. *alopecuroides* ...	*	...	...	*	...	*	*	...	*	*	
2. *Michelianus* ...	...	*	...	*	*	*	*	*	*	*	
3. *laevigatus* ...	*	...	*	*	*	*	*	...	*	...	
Total ...	2	1	1	3	2	3	3	1	3	2	

DISTRIBUTION OF SPECIES IN THE PRESIDENCY.—*contd.*

—	Sind.	Cutch.	Kathiawar.	Gujerat.	Khandesh.	Deccan.	Konkan.	W. Ghats.	S. M. Country.	N. Kanara.	—
CYPERUS.											
1. *cephalotes* ...	...	..	...	...	...	...	...	...	...	*	
2 *platystylis* ...	...	...	...	...	...	...	...	...	...	*	
3. *castaneus* ...	...	...	...	...	...	...	*	...	...	...	
4. *uncinatus* ...	*	...	...	...	...	...	...	*	...	.	
5. *Meeboldii* ...	...	...	...	...	...	.	...	...	*	...	
6. *difformis* ...	...	...	...	*	*	*	*	*	*	*	Conctd. in the Deccan.
7. *pulcherrimus* ...	*	...	...	...	...	...	...	...	...	...	
8. *flavidus* ...	...	*	...	*	...	*	*	*	*	*	Conctd. in the Deccan and Konkan.
9. *Haspan* ...	...	*	...		...	...	*	*	...	*	Conctd. in N. Kanara.
10. *Teneriffae* ...	...	...	...	...	...	*	...	..	*	...	
11. *niveus* ...	*	...	...	*	...		...	...	...	...	
12. *leucocephalus* ...	...	...	...	...	...	...	*	...	*	*	
13. *arenarius* ...	*	*	...	*	...	...	*	...	...	*	
14. *conglomeratus* ...	*	*	*	*	...	...	*	...	...	...	
15. *effusus* ...	*	...	...	...	...	...	...	...	...	...	
16. *Atkinsoni* ...	*	...	...	...	...	...	...	...	...	...	
17. *compressus* ...	*	...	..	*	...	*	*	*	*	*	Conctd. in the Deccan and N. Kanara.
18. *glaber* ...	*	...	...	...	...	...	...	...	...	...	
19. *aristatus* ...	...	...	...	*	...	*	*	*	*	*	Conctd. in the Deccan chiefly and N. Kanara.
20. *Iria* ...	*	*	...	*	...	*	*	*	*	*	Conctd. in the Deccan and Konkan.
21. *distans* ...	...	...	...	...	...	...	...	*	*	*	
22. *nutans* ...	...	...	...	...	...	*	*	*	*	*	
23. *eleusinoides* ...	*	...	...	*	*	*	*	*	*	*	Conctd. in the Deccan.
24. *pilosus* ...	...	...	...	...	...	...	*	*	*	*	
25. *procerus* ...	...	...	...	...	...	...	...	...	*	...	
26. *malaccensis* ...	*	...	...	...	...	..	*	...	...	*	
27. *bulbosus* ...	*	*	...	*	...	*	*	...	...	*	
28. *articulatus* ...	...	...	...	*	...	...	*	*	*	*	
29. *corymbosus* ...	*	*	...	*	...	*	*	*	*	*	Conctd. in the Deccan and Konkan.
30. *macer* ...	..	...	...	*	*	...	...	*	...	*	
31. *rotundus* ...	*	*	...	*	*	*	*	*	*	...	Conctd. in Sind, Deccan and Konkan.
32. *esculentus* ...	...	...	...	*	...	...	.	...	...	..	
33. *stoloniferus* ...	*	*	...	...	...	...	*	...	...	*	
34. *exaltatus* ...	*	...	...	*	*	*	*	*	*	*	
35. *digitatus* ...	.	...	...	...	...	*	*	*	*	*	
Total ...	17	9	1	16	5	13	21	17	18	22	
MARISCUS											
1. *blatteri* ...	...	...	...	...	...	...	...	*	...	...	
2. *bulbosus* ...	...	...	...	...	...	...	...	...	*	*	
3. *paniceus* ...	...	...	..	..	...	...	*	*	*	*	
4. *konkanensis* ...	...	...	...	...	...	*	...	*	...	...	
5. *pennatus* ...	...	...	...	...	.	...	*	*	...	...	Concentrated in the Konkan .
6. *compactus* ...	*	...	...	...	...	...	*	*	*	*	
Total ...	1	...	...	...	...	1	3	5	3	3	

DISTRIBUTION OF SPECIES IN THE PRESIDENCY.—*contd.*

—	Sind.	Cutch.	Kathiawar.	Gujerat.	Khandesh.	Deccan.	Konkan.	W. Ghats.	S.M. Country.	N. Kanara.	—
COURTOISIA											
1. *cyperoides* ...	...	...	...	...	...	...	*	...	*	*	Concentrated in the S. M. Country.
Total ...	...	...	...	...	...	...	1	...	1	1	
ELEOCHARIS											
1. *plantaginea* ...	*	...	...	*	...	...	*	...	*	*	
2. *fistulosa* ...	...	...	...	...	...	...	...	*	*	*	
3. *spiralis* ...	...	...	...	...	...	...	*	...	...	*	
4. *atropurpurea* ...	*	...	...	*	...	...	*	*	...	*	
5. *capitata* ...	*	...	...	*	*	*	*	*	*	*	Concentrated in the Deccan and Konkan.
6. *palustris* ...	*	...	...	...	...	...	...	...	...	...	
7. *chaetaria* ...	...	...	...	...	...	...	*	*	*	*	Concentrated in N. Kanara.
8. *congesta* ...	...	...	...	...	...	...	...	...	*	...	
Total ...	4	...	...	3	1	1	5	4	5	6	
FIMBRISTYLIS											
1. *tetragona* R. Br.	...	...	...	...	...	*	*	*	*	*	
2. *acuminata* ...	...	...	...	...	...	...	...	...	*	*	
3. *polytrichoides* ...	...	...	...	...	...	...	*	...	...	*	Concentrated in the Konkan.
4. *schoenoides* ...	*	...	...	*	...	...	*	*	*	*	
5. *argentea* ...	...	...	...	*	...	...	...	...	...	*	
6. *aestivalis* ...	...	...	...	...	...	*	*	*	*	*	
7. *dichotoma* ...	*	...	*	*	*	*	*	*	*	*	Concentrated in Gujerat, Khandesh and Deccan.
8. *spathacea* ...	*	...	...	*	...	...	*	...	*	*	Concentrated in the Konkan.
9. *annua* var. *diphylla* ...	*	...	...	*	...	*	*	*	*	*	Concentrated in the Deccan.
10. *ferruginea* ...	*	*	...	*	*	*	*	*	*	*	Concentrated in the Deccan and N. Kanara.
11. *digitata* ...	...	...	...	...	...	...	*	*	*	*	
12. *Woodrowii* ...	...	...	...	...	...	...	*	*	...	*	
13. *tenera* ...	...	...	...	*	*	*	*	*	*	...	Concentrated in the Konkan.
14. *junciformis* ...	*	...	...	*	...	*	*	...	*	*	Concentrated in the Konkan.
15. *miliacea* ...	*	...	...	*	...	...	*	*	*	*	
16. *quinquangularis*	*	...	...	*	...	...	*	*	*	*	
17. *complanata* ...	*	...	...	*	*	*	...	*	*	...	
18. *monostachya* ...	*	...	...	*	...	*	*	...	*	*	
Total ...	10	1	1	12	4	9	15	12	15	16	

DISTRIBUTION OF SPECIES IN THE PRESIDENCY.—*contd.*

	Sind.	Cutch.	Kathiawar.	Gujerat.	Khandesh.	Deccan.	Konkan.	W. Ghats.	S. M. Country.	N. Kanara.	
BULBOSTYLIS											
1. *barbata* ...	*	...	...	*	...	*	...		*	*	
2. *capillaris* var. *trifida* ...	...	...	...	...	...	...	...	*	*	*	
3. *puberula* ...	...	...	...	...	...	...	...	...	...	*	
Total ...	1	...	...	1	...	1	...	1	2	3	
SCIRPUS											
1. *Holoschoenus* ...	*	..	...	...	...	..	...	...	.	...	
2. *supinus* ...	*	...	...	*	...	*	*	*	*	*	Conctd. in the Deccan.
3. *articulatus* ..	*	...	...	*	...	...	*	*	*	*	Conctd. in the Konkan.
4. *quinquefarius* ..	*	*	...	*	...	*	*	...	...	...	
5. *corymbosus* ...	*	..	...	*	*	...	..	*	...	...	
6. *maritimus* ...	*	*	...	*	*	*	*	...	*	*	Conctd. on the sea coasts.
7. *triqueter* ...	*	...	..	...	...	..	...	...	...	...	
8. *grossus* ...	*	...	...	...	...	*	*	...	...	...	Conctd. in the Konkan.
9. *littoralis* ...	*	...	*	*	...	...	...	...	...	*	Conctd. in Gujerat.
10. *mucronatus* ...		...	..	*	...	...	*	*	*	*	
11. *erectus* ...	...	...	...	...	..	...	...	...	*	*	
12. *kyllingoides* ...	...	...	...	...	...	...	...	...	...	*	
13. *squarrosus* ...	*	...	.	*	..	...	...	*	...	*	
Total ...	10	2	1	8	2	4	6	5	5	8	
ERIOPHORUM											
1. *comosum* ...	*	...	...	*	*	*	...	...	...	...	
Total ...	1	...	...	1	1	1	...	...	...	...	
FUIRENA											
1. *wallichiana* ...	...	...	...	...	*	*	...	*	*	..	Concentrated in the Deccan.
2. *ciliaris* ...	...	...	*	*	...	...	*	*	*	*	Concentrated in the Konkan and S.M.C.
3 *uncinata* ...	...	...	...	...	...	...	...	...	...	*	
4. *umbellata* ..	...	...	...	.	...	*	...	*	...	*	Concentrated in the S. M. Country.
Total ...	...	...	1	1	1	2	1	3	2	3	
LIPOCARPHA											
1. *argentea* ...	...	...	..	...	...	...	...	*	...	*	
2. *triceps* ...	...	...	...	...	...	...		..	*	*	
Total ...	...	...	...	...	...	..	...	1	1	2	

DISTRIBUTION OF SPECIES IN THE PRESIDENCY.—*contd.*

—	Sind.	Cutch.	Kathiawar.	Gujerat.	Khandesh.	Deccan.	Konkan.	W. Ghats.	S.M. Country.	N. Kanara.	—
RHYNCOSPORA											
1. *wightiana* ...	...	...	...	...	...	*	*	*	...	*	Concentrated in the Deccan and Konkan.
2. *corymbosa* ...	...	...	...	...	...	...	...	*	*[1]	*	[1] Locality doubtful.
Total ...	...	...	...		...	1	1	2	1	2	
SCHOENUS											
1. *nigricans* ...	*	...	...	...	...	...	...	...	...	...	
Total ...	1	...	...	...	...	...	...	...	...	...	
REMIREA											
1. *maritima* ...	...	...	...	...	...	...	...	...	...	*	
Total ...	...	...	...	...	...	...	...	...	...	1	
HYPOLYTRUM											
1. *latifolium* ...	...	...	...	...	...	...	...	*	...	*	
Total ...	...	...	...	...	...	...	...	1	...	1	
SCLERIA											
1. *tesselata* ...	...	...	...	...	...	...	*	...	...	*	
2. *lithosperma* ...	...	...	...	...	...	...	*	*	...	*	Conctd. in N. Kanara.
3. *corymbosa* ...	...	...	...	...	...	...	...	...	*	...	
4. *hebecarpa* ...	...	...	...	...	...	...	*	...	...	*	Conctd. in N. Kanara.
5. *poaeformis* ...	...	...	...	...	...	...	...	...	...	*	
6. *cochinchinensis*.	...	...	...	...	...	...	...	*	...	*	
7. *annularis* ...	...	...	...	...	...	...	*	...	...	*	
8. *Stocksiana* ...	...	...	...	*	...	*	*	*	*	*	
Total ...	...	...	...	1	...	1	5	3	2	7	
DIPLACRUM											
1. *caricinum* ...	...	...	...	...	...	...	...	...	...	*	
Total ...	...	...	...	...	...	...	...	...	...	1	

DISTRIBUTION OF SPECIES IN THE PRESIDENCY.—*contd.*

	Sind.	Cutch.	Kathiawar.	Gujerat.	Khandesh.	Deccan.	Konkan.	W. Ghats.	S. M. Country.	N. Kanara.	
CAREX											
1 *nubigena* ...	*	...	...	...	...	...	...	...	...	...	
2. *foliosa* ...	*	...	...	...	...	...	...	...	...	...	
3. *brunnea* ...	*	...	...	...	...	...	...	...	...	...	
4. *cruciata* ...	*	...	..	...	...	...	...	*	...	...	
5. *filicina* var. *minor et* var. *meiogyna* ...	*	..	...	...	...	...	...	...	...	...	
6. *Lindleyana* var. *major* ...	...	...	...	...	...	...	*	*	*	*	Conctd. in the Deccan and N. Kanara.
7. *baccans* ...	...	...	...	...	...	...	...	*	...	...	
8. *speciosa* ...	...	...	...	...	...	...	...	...	...	*	
9. *glauca* var. *cuspidata* ...	*	...	...	...	...	...	...	...	...	...	
10. *setigera* var. *Schlagintweitina* ...	*	...	...	...	...	...	...	...	...	...	
11. *Halleriana* ...	*	...	...	...	...	...	...	...	...	...	
12. *breviculmis* ...	*	...	...	...	...	...	...	...	...	...	
Total ...	9	...	...	...	...	...	1	3	1	2	

SOME NOTES ON THE GEOGRAPHICAL DISTRIBUTION OF THE CYPERACEAE IN THE PRESIDENCY.

Of the 135 species recorded so far from the Presidency 16 are peculiar to Sind, viz.:

Cyperus pulcherrimus Willd.
Cyperus effusus Rottb.
Cyperus Atkinsoni C. B. Clarke
Cyperus glaber Linn.

Eleocharis palustris R. Br.
Scirpus Holoschoenus Linn.
Scirpus triqueter Linn.
Schoenus nigricans Linn.

Carex nubigena D. Don.
Carex foliosa D. Don.
Carex brunnea Thunb.
Carex filicina Nees var. *meiogyna* et var. *minor*.
Carex glauca var. *cuspidata*.
Carex setigera var. *Schlagintweitiana*.
Carex Halleriana Asso.
Carex breviculmis R. Br.

One to Gujerat: *Cyperus esculentus* Linn.
2 to the Konkan: *Pycreus hyalinus* Don, and *Cyperus castaneus* Willd.
2 to the W. Ghats: *Mariscus Blatteri* McCann, and *Carex baccans* Nees.
3 to the Southern Maratha Country: *Cyperus Meeboldii* Kükenthal, *Eleocharis congesta* Don, and *Scleria corymbosa* Roxb., and 9 to N. Kanara.

Cyperus cephalotes Vahl.
Cyperus platystylis R. Br.
Bulbostylis puberula Kunth.
Scirpus kyllingoides Boeck.
Fuirena uncinata Kunth.
Remirea maritima Aubl.
Scleria poaeformis Retz.
Diplacrum caricinum R. Br.
Carex speciosa Kunth.

How are we to explain this peculiar distribution? The large number of species peculiar to Sind may be accounted for by the presence of the Indus River as it may be responsible for the introduction of some of the species from the northern part of India. But this alone does not seem to account for this distribution. Sind is the wintering ground for many wild fowl such as ducks and waders, some of which never descend lower down into the Presidency. A great number of these migrant birds come from the North, North-West and West and in so doing bring along the seed of various plants in the mud that frequently adheres to their bills, feet and plumage, and have in this way added to our Cyperaceous flora especially as this order comprises plants that are inhabitants of marshes and stretches of water. For example *Cyperus glaber* is so far only recorded from Sind, the distribution is given as 'Westwards to Sicily'; similarly *C. effusus* has also only been recorded from Sind the distribution being given as westwards to N. Africa. Is it not possible that these two species were introduced by aquatic birds? Some of these records are over thirty years old and it appears strange that since that time (Pinwill) they have not been obtained again. It seems very probable that these were just chance specimens which happened to survive for a short time in the new locality and then died out. Sind is poorly explored, and this may also account for the absence of further data.

Khandesh is in a similar position as Kathiawar, but for the few records places are unexplored from a Cyperologist's point of view as is easily seen from the records we have at hand. Fr. Blatter collected in Cutch during the winter of 1907-08, but as these plants are so much dependent on water it was an unsuitable time. Kathiawar is almost a blank; there is not the slightest doubt that it still remains a closed book as there has never been any serious collecting done in the area.

Khandesh is in a similar position as Kathiawar but for the few records from the West and along the Tapti River made by Fr. Blatter, the late Prof. Hallberg and Mr. McCann during the winters of 1916-17 and 1918-19. Both these trips were of short duration and the time was most unsuitable for *Cyperaceae*. We are sure that with the further investigation of these areas the distribution of some of the species will be extended.

Coming down to the W. Ghats 2 of the 3 species are from the Mahableshwar ranges, whose heavy rainfall might well be compared with that of N. Kanara. The demarcation between the W. Ghats and the Konkan is very vague and it is difficult to attribute this or that species to one or the other of these areas. Two species are peculiar to the Konkan. The Southern Maratha Country yields three species peculiar to it but as there is no saying where the S. M. Country ends and Kanara begins perhaps a few more species might as well be added to those already mentioned for Kanara.

How are we to account for the large number of species peculiar to Kanara? Kanara was well explored by Talbot, whose large collections testify to this, and also by subsequent collectors. This may be one of the reasons but the Konkan has also been well explored and yet the number is small compared with that for Kanara. It is possibly due to the heavy rainfall Kanara receives and also to the dense evergreen forests. The Nilgiris hold some of the species and perhaps also the adjoining country which is still unexplored. Is it possible that some of these plants have come with wandering animals, such as elephants, bison and deer? But we know very little on this point to draw any definite conclusions. Most of the species that occur in Kanara are forest species, *Remirea* alone occurring on the sandy seacoast.

(To be continued).

Crossing the Menik Ganga, Ceylon.

Spotted Deer (*Axis axis*) at margin of forest.

A GAME SANCTUARY IN CEYLON.

BY

Lieut.-Col. R. W. Burton,

Indian Army (retired).

(*With a plate*).

It was with the kind permission of the Minister for Agriculture and Lands, and in the company of the Government Agent for the Southern Province (Mr. J. D. Brown), and his Assistant for the District of Hambantota (Mr. F. L. Leach), that the writer had the privilege to visit the Yala Game Sanctuary in February 1933.

This Sanctuary came into existence in February 1899, the area set apart being bounded on the east by the Kumbukkan-oya, on the south by the sea, the west by the river Menik Ganga, and the north by a demarcation line cleared through the jungle. In length about 16 miles by 10 miles wide the Sanctuary has an area of approximately 170 square miles which is under the supervision of a Ranger, with twelve watchers under his control. The area is further protected on three sides by Reserved Forests patrolled by game watchers.

Having been furnished with letters of introduction to the President and to the Honorary Secretary of the Ceylon Game and Fauna Protection Society, also to Mr A.C.Tutein-Nolthenius, F.Z.S., of the Executive Committee, by our late Honorary Secretary Sir Reginald Spence, it was under very favourable auspices that the visit was made.

On the evening of the 9th February 1933 we all met together at the Tissamaharama Rest House, the party of five including Mr. A. R. Hughes, ornithologist and expert amateur photographer. The care with which all Rest Houses in Ceylon are provided with a mosquito-proof room and a full supply of mosquito curtains was much appreciated, for we all enjoyed a good night's rest undisturbed by the singing whine of the myriads of these pests for which Tissa is famed.

On our way through the Palatupane Reserve on the following day the country was verdant from the recent unusually prolonged monsoon rains; many pretty wild flowers bordered the paths; and the sweet scent of flowering shrubs and creepers was in the air. A skylark enchanted us with his aërial song so reminiscent of the home land; in and around the open sheets of water were a number of birds—redshanks, sandpipers, stints, godwits, golden-plover, cattle egrets, terns, painted storks, and many others. Green bee-eaters hawked the air 'chasing the purple butterflies', a pied crested cuckoo was seen jumping after insects in the grass; while kites and hawks circled in the clear blue sky. All nature seemed to smile in approval of our peaceful mission.

A few miles beyond the Palatupane Rest House we emerged into a large open space in the centre of which was a pool of water. The scene was reminiscent of an African game country. Buffalo and spotted deer lay peacefully about or grazed on the short herbage; sambur rested or fed along the edge of the forest; sounders of wild pig rooted in the grass; and some jackals were observed returning from a drink at the pool.

These jackals were fine dark-coloured animals, seemingly larger and more handsome than the Indian species. There are no wild dogs in Ceylon. Jackals have been seen hunting in packs to pull down the smaller deer, but now the animals took no notice of them.

Other similar scenes were observed further on—good augury for what we would enjoy in the Sanctuary—and as the sun sank behind the sand-hills separating us from the sea, we arrived at the Yala Ranger's Bungalow on the bank of the Menik Ganga. Soon the full moon soared above the trees on the further side to flood our camp with its welcome light; a sambur hind voiced her alarm at the scent of a prowling leopard; the nasal croaking of the barbets was unceasing.

We looked apprehensively upon the turbid flood of the river rolling toward the sea and wondered whether the carts could make the crossing in the morning. All of us, men and cattle alike, had earned a night's rest after the long march of some twenty-six miles, and lulled by the ceaseless surge of the waves upon the shore were soon soundly sleeping.

The camp was early astir as the crossing of the river might be a lengthy business, and there would be twelve miles of mostly sandy track before tents could be pitched.

The ford is about half a mile up stream. One of the game watchers entered the water, found the end of the wire hawser broken by some tree trunk hurled down the river in a recent flood. Gaining the further bank he quickly procured a length of liana, strong as any hawser, to make the necessary connection to the other side. It was a relief to see that the depth would not prevent the passage of the carts.

We all stripped and crossed to watch the baggage being carried over on the men's heads. Then the empty carts were driven down the steep bank to be hauled through the strong stream by the diminutive bullocks sometimes swimming and sometimes wading and all the time encouraged by much noise as is the custom in the East. Safely across, the seven carts were soon again plodding along beneath the shade of the fringe of tall evergreen trees bordering the river banks to emerge under a hot sun into the more or less open country which was our first view of the Sanctuary, and through which the cart track leads to Pahala Potana.

Roaming about in advance of the carts, I failed to get a snapshot of a bull buffalo in a wallow; but by careful stalking managed to photograph a small herd feeding close to a reedy pool, obtaining a second 'shot' as they moved off.

The open spaces were alive with parties of buffalo, while all along the fringe of the jungle were groups of spotted deer. The animals merely moved quietly away on the appearance of the long string of carts and men; but only with a telephoto lens would it have been possible to obtain effective pictures. We hoped that those taken by Hughes would prove successful.

The heat was considerable, and as the day drew to a close these spaces would be covered with animals. Pig we saw, and signs of elephant; the sambur were all in the shade of the trees along the sand dunes, the area in the Sanctuary to which many of them are particularly partial.

At the place where we stopped for lunch was the skull of a long-defunct elephant which afforded a seat, and by the side of the path were the leg bones which had been used as a fire-place. During the wanderings in these jungles the remains of four elephants were seen, but of buffalo and other animals no bones were found.

It was when the shadows were fast lengthening that we neared the camping ground. Many herds of spotted deer scattered before the rumbling carts, and on emerging from the forest we gazed in astonishment at the scene before us. All about the plain, through the mile-long length of which meanders a running stream, were scattered herds of buffalo; along the further side were large herds and parties of spotted deer numbering perhaps seven hundred, while within the fringes of the forest were more animals. Probably there were a thousand deer, but the failing light prevented a more accurate computation. Sounders of pig wandered about, the tiny porkers scuttling to and fro, fencing with one another on their hind legs, and generally behaving like playful puppies; jackals roamed unconcernedly among the beasts whose bones they would some day pick when they fell victims to leopards or disease, for in Ceylon there are no vultures to dispute the feast.

It was only the centre part of the long plain which was in view as the ends curled out of sight. It was realized that the stock of game is very abundant, and this was confirmed by similar sights observed by the Government Agent, and other members of the party, who went further east on the following day to Uda Gajabawa and other open spaces. Everywhere roamed herds of buffalo and deer.

The night passed quietly. There were no alarm calls of sambur or spotted deer, no trumpetings of elephant, yet leopard and elephant must have been in the vicinity. The hours of darkness seemed to brood and be expectant, for one peoples the night with one's fancies. Lying awake I called to mind many forest vigils when the quiet of the jungle had sunk to night's absolute stillness and the ear was cocked to hear the sound of heavy footsteps. I could picture the deer moving fearfully, peering, sniffing, treading delicately lest a twig should snap, a branch rustle, ears moving to catch every little sound. Later in the night there would be absolute stillness, but in the early hours there is always the noise of little things on the prowl; quick stealthy noises, little rustlings and patterings, little sudden pouncings. Ah! the delight of those forest vigils! And so came dreamless sleep.

It was most interesting the next morning to see the cameras set for flashlight pictures, and I learnt from Hughes much of this fascinating pursuit. On our way to find a suitable 'run' a fine leopard was seen lapping at a pool. Buffalo and deer stared, but little perturbed by the unwonted sight of human beings. Were the Sanctuary more accessible to visitors— as it will be some day when it is a National Park—the animals would be less timid, for with familiarity would come the confidence born of the knowledge that man is not an enemy.

On our way back to camp a fine bull was spied in his wallow in the open plain. Stooping low and stepping warily in light rubber shoes I got to within fifteen feet of the recumbent form. He was not asleep, but did not hear the slight click of the shutter. The film wound off ready for another 'shot', a small piece of mud roused the old fellow from his siesta. Up he got with astounding agility for so bulky an animal and was twenty yards away in a second. Then he wheeled around to stare at the intruder and afforded a second 'shot'. Now Hughes advanced on him to take his picture with the telephoto lens, but even then he only walked slowly off to stand disgruntled with the stolid bovine stare of his species. On return to camp one of the servants, hearing the story related, enquired, 'Did he come to bite you?' at which there was much amusement.

In the open plain were two big bulls who appeared to have fixed a bend in the stream as the dividing line of each other's territory. One of them had his left horn broken off about a foot from the tip, no doubt in one of the terrific battles they have from time to time. They appeared to be surly brutes, and the Ranger begged me not to try and take a close 'shot', so I left them alone.

In the evening another camera was set for flashlight, and on return of the Government Agent at sunset we heard of all that had been observed towards the eastern boundary. Tutein-Nolthenius, keen naturalist and expert collector of the smaller mammals, related much that was of interest concerning the fauna of Ceylon. Recently he had obtained most rare and interesting specimens of wild cats in the coastal area near Hambantota.

As the shades of evening deepened animals began to come into the open, but not in such numbers as were seen on our arrival. No doubt the sight of the tents, the voices of the camp, and the light of the fires had scared the beasts accustomed to solitude. Watching with field-glasses, until the darkness descended and night stretched its smooth veil over the magic scene, it could be observed that more and more shadowy forms were advancing into the open. The buffaloes loomed as large as elephants.

It was dark now and the sky unclouded, but soon the round disc of the moon appeared, the trees threw queer shadows, and the camp fires blazing up spouted arrows of gold and scarlet against the dark background of the forest.

When living close to Nature one is early awake. The gentle wind that ushers in the dawn of day came scent-laden with the freshness of the blossoming forest trees and the camp was quickly astir. On this, the last day of our stay, three of us were to go to a small range of hills some five miles to the north, while Messrs.

Brown and Hughes stayed to attend to camera work and complete the list of birds observed in the Sanctuary, which is appended to this article.

That expedition through the forest has unforgettable memories. Of all the party—which included the Ranger and four of his watchers—none had been there, and it seems that no one has visited those hills for many years.

About a mile from camp we came upon the Nabbadagas Wewa, a reed-bordered tank in which grow a number of thorn and other trees. Here was a colony of snowy white egrets, while in and around this jungle lake were many species of birds: a paradise this for the ornithologist and the wild life photographer for here we saw sambur and spotted deer, and all the animals of the Sanctuary visit the place.

Proceeding on our way a herd of spotted deer afforded a photograph; then a fine bull buffalo, stalked to within fifteen feet, was alarmed by some movement of one of the party peering behind to see the fun and away in that unexpectedly rapid manner before his picture could be taken; for it is not easy to retain such quick-moving objects in the small view-finder.

More buffalo were seen, also pig and deer, and a cow elephant moved quickly across an open space. I was just too late to 'shoot' her before she gained the shade of a tree, so we all sat down and watched, not twenty yards away, secure from detection as the steady wind was in our favour. A herd was somewhere about but time did not permit of delay so its picture is not with me.

More animals we met, and a leopard was seen by one of the men. Then came the struggle up the steep hillside through the weeds and undergrowth and the finding of a game track to take us to the summit of Mandagala, as the hill is called. The highest point is 523 feet above sea level and on it is a cairn of stones erected by the Survey Department.

Seated on the top of the hill we had a grand view of all the Sanctuary. The long plain of Pahala Potana, the line of the sea coast, the Little Basses light-house, a great passenger liner bound for Colombo, the trees marking the course of the Kumbukkan-oya to the east, the darker greenery marking the extensive but now empty bed of the Mandagala tank just below the hill, and the similar indication to the west of the Athurumithuru Wewa the drainage from which forms the streams which run to the Pahala Potana; all these we saw, and also a few small open spaces in which were buffalo in their wallows and sambur and deer in the shade of trees.

One's thought naturally turned to the needs of the Sanctuary. These will be ably set out in the Official Report of the Government Agent but can be confidently anticipated to include:—an improvement to the water supply of the area by repair of such tank embankments as can be carried out; the opening up of the country by means of 'rides', after the manner of fire lines of Indian forests, to facilitate proper watching and inspection; the clearing of more open spaces to improve the grazing.

The thirty-six years of protection has evidently permitted the animals to greatly increase, and now they ask for more grazing and more water so that they can spread more widely through the forests. The photographs taken show how poor in condition are the buffalo in comparison to the wild animals of the Central Provinces of India, and this at a season when they have had the fortune of a North-East Monsoon far in excess of the average and extended much beyond the usual date. In this, the dry zone, where the rainfall is but 20 to 50 inches, the animals must suffer much during the hot months from overcrowding at the water pools.

Reluctantly we made our way down the hill to retrace our steps to camp. All the time we saw animals, and close to the egret pond there was a crocodile basking on the grass. He wasn't as fast asleep as he seemed, for he made off just as he had been satisfactorily posed in the view-finder. The two surly buffaloes were still eyeing one another; a fine bull was making affectionate demonstrations to a ponderous spouse at the lower end of the plain; a large snake swished away in the grass; and then, wading through the warm waters of the stream, we arrived at camp as the declining sun turned the leaves of the trees into glowing copper. So ended a glorious day and we slept wrapped in the mystery of the tropic night.

When leaving the camp next day on our return journey, a herd of some twenty elephants was close to the path. The cover was too thick to admit of an attempt at photography so two of our party crept quite close to see the shadowy forms of big mothers and small calves. Further on many deer were viewed, and an elephant hurried to cover on the approach of the carts to the lake and open space of Uda Potana. It was sad to know that all the water we were seeing would be soon dried up, and the herds forced to congregate along the banks of the river the waters of which would have dwindled to scattered pools.

The crossing of the Menik Ganga presented no difficulty. Then came lunch and a bathe and so to camp, where the buffalo grazed unconcerned a couple of hundred yards away.

The morning of the 15th February I set out in company with Mr. Brown to work through the jungle and see the Elephant Rock, that conspicuous landmark so well known to many Ceylon sportsmen, and with this further insight into the forests of Ceylon my most interesting visit came to an end.

With all the memories of those five days, followed by three days at the Wirawila Bird Sanctuary in the charming company of Mr. Charles Northway, renowned elephant hunter and sportsman (since deceased and greatly regretted by all who knew him), and our xpert ornithologist Mr. Hughes who drove me the 167 miles to Colombo along the picturesque coast road, there is a deep debt of gratitude to all those who made the visit possible and so enjoyable in every way.

I have had the good fortune to see a number of game preserves and sanctuaries. The Pidoung Sanctuary in Upper Burma; the wonderful herds of swamp deer in the Kheri forests of Oudh; the Sanctuary in the Orrcha State where you may almost stroke the noses of the sambur; that now unique herd of some 5,000 antelope in the Punjab; the hundreds of Urial in the preserve of a Punjab Landowner; the elephant and bison around the Peryar Lake in Travancore; but nowhere have I seen so much varied wild life in its natural state as in the Yala Sanctuary.

I shall live in hope of an opportunity to again see, not the Yala Sanctuary, but the YALA NATIONAL PARK renowned through the East for the wonders of the Wild Life it contains.

Since the above was written some commencement has been made as to clearing inspection paths, but without an allotment of funds by the Ceylon Government the increased grazing and water which the herds require cannot be provided and the unfortunate animals must inevitably greatly suffer during those blazing months when the whole country is parched and dry. It is not difficult to picture to oneself the terrible sufferings of the thronging herds—insufficient water, no grazing; horrible.

For thirty-six years the Yala Sanctuary animals have multiplied in peaceful security and it is now the obvious duty of the Government to allot funds for the conservation of the poor beasts which, in the absence of speedy action, had better have been left to the more tender mercies of the meat poachers and the purveyors of hides!

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS.

(ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, M.B.O.U., assisted by N. B. KINNEAR, M.B.O.U.

PART XI.

(*Continued from page* 763 *of volume* xxxvii).

Dichoceros bicornis (Linnæus).

Buceros bicornis Linn., Syst. Nat., ed. x, vol. i (1758), p. 104—China *errore*, Travancore.

The Great Hornbill is not found on the eastern side of the Presidency. On the west it is well distributed. William Davison states that he found it not uncommon in the forests of the Wynaad, once seeing as many as 50 together in the cardamom forests of the Peria Ghat. On the slopes of the Nilgiris it is less common. Davison never saw it above Burliar; Jerdon says it occurs up to 5,000 ft. on the eastern slopes; and Mr. Betts tells me that the only one he saw was at 4,500 ft. in the Ochterlony Valley.

Kinloch considered it very common in the Nelliampathies. Fairbank does not seem to have met it in the Palnis but Terry found one in the Pittur Valley.

The Great Hornbill occurs, according to Bourdillon, throughout the whole range in Travancore, a pair or so being found in every glen or valley of any size, the bird being numerous nowhere except perhaps in some of the wilder jungles on the lower slopes of the hills. Here the breeding season is said (Stuart Baker, *Nidification*, iii, 430) to be in February, March and April. According to Bourdillon (*N. & E.*, iii, 70) the old birds pair in January and the young first show themselves in May, shortly before the rains of the S.-W. Monsoon commence.

As no specimens of this and the next species were obtained by the Survey I have not attempted to check their systematic status or possible races.

Hydrocissa coronata (Boddaert).

Buceros coronatus Boddaert, Tabl. Pl. Enlum. (1783), p. 53 based on Pl. Enlum., pl. 873—Philippines *errore*—Malabar.

The Malabar Pied Hornbill was not observed by the Survey and on the eastern side of the Presidency it is only recorded as occurring at Gumsoor in Ganjam (Jerdon, *B. of I.*, i, 246) on the southern boundary of its range in the Chota Nagpur area.

On the west it occurs, according to William Davison, in the evergreen forests of the Wynaad and on the lower slopes of the Nilgiris. Kinloch says that it is very common in the Nelliampathies. In Travancore, according to Ferguson, it is by no means common and is locally distributed in forest land about the foot of the hills.

The breeding season in the Presidency is not recorded.

Tockus birostris (Scopoli).

Buceros birostris Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 87 —Coromandel.

Specimens collected:—252 ♂ 19-5-29 Shevaroy Hills 4,000 ft.; 289 ♀ 29-5-29 Chitteri Range 2,000 ft.; 732 ♂ imm. 22-8-29 Palkonda Hills 1,000 ft.

Measurements:—

	Bill.[1]	Wing.	Tail.	Tarsus.
♂ ad.	104	209	254	42 mm.
♂ imm.	84	204	246	44 mm.
♀	97	203	252	42.5 mm.

The Common Grey Hornbill has not been recorded in the Presidency north of the Palkonda Hills where the above specimen was obtained by the Survey. Captain Bates informs me that, though he has never seen it in the vicinity of Madras in spite of the well-wooded character of the country, it occurs commonly in the hilly country between Ranipet and Chittoor. There is a specimen from Udayagiri in the Madras Museum.

In Salem District, LaPersonne reports that it was not common in the Shevaroys at 4,000 ft. and that isolated pairs were met in the forest tracts of the Chitteri range. At Kurumbapatti it was fairly common.

On the western side there are only two records. A male, now in the British Museum, was obtained on the Coonoor Ghat by Wardlaw Ramsay on 12 September 1876 and Fairbank obtained a specimen in the avenues of the town of Palni in October 1876.

This species has no races.

Tockus griseus (Latham).

Buceros griseus Latham, Index Orn., vol. i (1790), p. 147—New Holland *errore*—Malabar.

In the Presidency, the Malabar Grey Hornbill is confined to the western side. There, according to William Davison, it occurs throughout the Wynaad and all about the base of the hills though it does not ascend their slopes. In the Nelliampathies it is very common (Kinloch). Fairbank records (*S.F.*, v, 395) that he obtained a specimen from a flock at the eastern base of the Palnis in 1867 though he seemed afterwards to have some doubt about the correctness of his identification. In Travancore, Bourdillon says (*S.F.*, iv, 387) that it is common in heavy jungle from 1,000 ft. to 3,000 ft., but Ferguson says that it is commonest at about 3,000 ft. especially on the Cardamom Hills. The latter shot it as high as 5,000 ft. on the High Range and at 4,000 ft. on Chimunji. In *Nidification*, iii, p. 441, however, Bourdillon is quoted as saying that it is more common below than above 2,000 ft. and actually sometimes occurs and breeds in the plains. The breeding season is said (*loc. cit.*) to be from January to early April, most eggs being laid in February.

Tockus gingalensis Shaw of Ceylon is very close to the Malabar Grey Hornbill, but may perhaps be considered to have attained the rank of a full species.

Upupa epops ceylonensis Reichenbach.

Upupa ceylonensis Reichenbach, Handb. Spec. Orn., Scans. (1851), p. 320—Ceylon.

Specimens collected:—533 ♂ 8-7-29 Vyampatti, Trichinopoly; 573 ♀ 21-7-29 Gingee; 1018 ♂ 19-11-29 Nallamalai Range 2,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	58.5-60.5	132-132.5	92.5-95	21-21.5 mm.
1 ♀	46	126	87	18.5 mm.

There is little on record about the status of the Hoopoe on the eastern side of the Presidency. With the exception of the above specimens and Mr. LaPersonne's note that in Salem District it ascends the hills to 4,000 ft. and is common on the Chitteri Plateau as well as in the open forests round Tirthamalai, we only know that it is common round Madras (Dewar).

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[1] From base of casque to tip of bill in a straight line.

In Coorg, Mr. Betts considers it uncommon, to be seen occasionally in the cold weather on dry open maidans. William Davison says that it is a not uncommon resident in the Wynaad and on the Nilgiris and their slopes.

Kinloch says that it is uncommon on the Nelliampathies, but may be found in pairs in certain favoured localities. In the Palnis it is generally distributed.

In Travancore, according to Ferguson, it is most common in the drier regions of the south in the low country. He adds that during the hot weather about March it may be found in the hills, even ascending the High Range.

The breeding season in the Nilgiris is said to be in April and May (Cockburn and Davison, *N. & E.*, ii, 334), but Major Phythian-Adams considers that it nests chiefly in February (*Birds of S. India*, p. 188).

All the Hoopoes that I have examined from the Presidency undoubtedly belong to the richly coloured form which is found in Ceylon. This is a small bird. Six specimens from Ceylon (♂ ♀) have wings measuring 120.5-134 mm., and Presidency specimens measure:—11 ♂ wings 131.5-138.5 mm., 5 ♀ wings 123-130 mm. This race Mr. Stuart Baker (*New Fauna*, iv, 312) considers to extend up to about the Deccan and the Bombay Presidency, intergrading on a line roughly about the latitude of Khandesh with a paler and larger race *E. e. orientalis*. This however does not agree with the results of my examination of the group. I can see no constant difference in colour in the resident Hoopoes anywhere from Cape Comorin up to Futtehgarh and Etawah in the Western United Provinces and two birds labelled Naini Tal (but perhaps from the terai below) in the Hume Collection also agree with them. As to size sixteen specimens from Futtehgarh and Etawah in the British Museum measure 119-140 mm., the sexed birds being as follows:—

6 ♂ wings 131-140 mm., 5 ♀ wings 119-132 mm.

In the Punjab grading into the typical race begins. Punjab breeding birds are pale in colour, approaching the typical race, and in size they are small approaching *ceylonensis*. The wings of 5 males in my collection measure 133-143.5 mm., of 3 females 128-130 mm. For this intermediate race—if it is worth recognition—we may use Stuart Baker's name *Upupa epops orientalis* [*Bull., B.O.C.*, xlii (29 November 1921), p. 29] which is merely a new name without description for *Upupa indica* Reichenbach (*Handb. Spec. Orn., Scans.* (1853), p. 320—India). This name I now restrict to Ambala, as Stuart Baker evidently had in mind (*New Fauna*, vol. iv, p. 311). His measurements (wing 128-160 mm., average 135 mm., practically all sexed males have a wing of over 150 mm.) are far too large whether for his or my use of the name and must be due to confusion with immigrants of the typical race. I accept Madame Koslov's view (*Ibis* 1932, p. 589) that *Upupa epops saturata* is not a good race.

[**Upupa epops epops** Linnæus.

Upupa epops Linnaeus, Syst. Nat., ed. x, vol. i (1758), p. 117—Europe, restricted to Sweden.

Although I have examined no Hoopoe from the Presidency which can be attributed to the typical race there can be little doubt that it occurs as a winter visitor. Ball records it from Jeypore (*S.F.*, vii, 209) and Fairbank definitely states (*S.F.*, v, 399) that he shot a specimen in the Palnis. It has in any case been obtained just on our borders for two specimens were collected by Mr. Salim Ali during the Hyderabad Survey at Paloncha 300 ft. on 21 November 1931.]

Harpactes fasciatus malabaricus (Gould).

Trogon malabaricus Gould, P.Z.S., 1834 (June 9), p. 26—Malabar Coast.

No specimens of the Malabar Trogon were procured by the Survey though Mr. LaPersonne reports that a pair were seen at Sankrametta at 4,000 ft. It had already been reported in this area by Ball who states that he met it on two occasions at Jeypore (*S.F.*, v, 413). Blanford obtained a male north of Ellore on 7 April 1871 and this specimen is in the British Museum.

In the west of the Presidency it is much better known. A pair from Calicut are in the Hume Collection. William Davison says that this Trogon, though nowhere abundant, occurs all through the Wynaad and up the slopes of the Nilgiris to at least 6,500 ft. He observed it in the forests of the Droog, at Coonoor, at Pykarra and Neddivattum. Phythian-Adams (*Birds of S. India,*

p. 190) considers it distinctly uncommon in the Nilgiris, remarking that in the past three years he had only seen one, at Madumalai at 3,000 ft.

Kinloch considered it common in the Nelliampathies. Fairbank met with three in his visit to the Palnis and secured a female at Vengayam (east base) on 28th May and a male at Shemiganur 5,000 ft. in June (*S.F.*, v, 393). The latter is in the British Museum.

In Travancore the Trogon is said to be not uncommon at heights above 1,000 ft. in heavy jungle. A nest with two slightly incubated eggs was obtained by Bourdillon on 22 March 1878 and is described in *S.F.*, vii, p. 172. The breeding season in Travancore is said to extend from February to May (Stuart Baker, *Nidification*, iii, p. 448).

I have not been able to examine any specimens of this Trogon from the Chota Nagpur-Vizagapatam area to verify this subspecific agreement with birds from the Malabar Coast. The typical race from Ceylon is distinctly smaller though the difference in colour is not very marked except in the female. The *New Fauna* does not make it quite clear how far north the Malabar race extends. Although James Davidson does not include it in his list of species from Western Khandesh (*S.F.*, x) there are specimens from Khandesh in both the Tweeddale and Hume Collections and after the date of his list Davidson himself procured a male (now in the British Museum) on 25 April 1886 in the Dangs, Khandesh. Three of these Khandesh specimens are markedly paler than Malabar birds but I am not yet satisfied that the difference is subspecific.

Micropus melba bakeri (Hartert).

Apus melba bakeri Hartert, Nov. Zool., vol. xxxiv (1928), p. 363—Catton Estate, Ceylon.

No specimen of the Alpine Swift was procured or reported by the Survey. It is very difficult to unravel the meaning of the movements of this Swift as we have no accurate conception of the distances it may fly during the day from its roosting places. These may well be very great. There is a well known roosting place—and probably also breeding place—in the cliffs of the great waterfall at Gairsoppa in North Kanara, described by Jerdon (*B. of I.*, i, 176) and by James Davidson (*J.B.N.H.S.*, xii, 47). Here vast numbers arrive nightly and Vidal (*S.F.*, ix, p. 43) suggests, with the greatest probability in my opinion, that this is the roosting place to which the numbers he saw flying southwards every evening in the South Konkan were bound, to which stream are also probably added the birds that pass over Belgaum (Butler, *S.F.*, ix, 379). This roost doubtless draws the birds also from the south as Jerdon remarks that at Tellicherry he frequently saw the birds flying southwards early in the mornings.

All the Presidency birds do not however come from Gairsoppa. H. R. P. Carter saw parties flying from S.-E. to N.-W. near Coimbatore in the early morning of 5 October (*S.F.*, i, 474). William Davison (*S.F.*, x, 347) says that there is apparently a permanent colony at St. Catherine's Falls at Kotagherry[1] and a few are generally to be seen at the falls at Kartary (Karteri) and Pykarra. Terry also suggests that there is a roosting or breeding place on one of the cliffs near Pittur in the Palnis (*S.F.*, x, 469). It is not clear why Kinloch suggests that it is only common during the cold weather on the Nelliampathies, and Ferguson's statement that Alpine Swifts are to be seen in numbers at grass fires on the High Range of Travancore is very inadequate.

Jerdon says that occurring all along the line of the Western Ghats down to Cape Comorin, being at times very abundant on the Nilgiris, this Swift extends its daily flights often to the western seacoast and occasionally eastwards to Salem, Madura and even Madras. He adds that on several occasions he saw large flocks flying eastwards towards the sea from the rocky hills near Madura about sunset. On another occasion he saw an enormous flock flying eastwards from the same range a little south of Madura. The eastward movement at sunset suggests that the big colonies in Ceylon mentioned by Legge and more recently by W. W. A. Phillips (*Ceylon Jour. Science*, Section B, vol. xviii, p. 252) supply their quota of daily visitors to the Presidency.

The small number of Presidency specimens available for examination all belong to the small form separated by Hartert. Eleven specimens from the

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[1] According to Mr. Salim Ali who investigated the neighbourhood in 1932, this colony has now disappeared—EDS.

Presidency and Ceylon measure: bill 16-17.5 mm., wing 193-213 mm., tail 70-78.5 mm. as compared with a series from Europe and Upper India wing 206-224.5 mm., tail 68-87 mm. In colour they tend to be darker. The two specimens from Ceylon in the British Museum are very dark indeed, being very close in colour to *M. a. africana,* though this latter usually has the white parts black shafted. The Presidency birds vary in colour and some are no darker than birds from Northern India, but no doubt sun and air pressure bleach the plumage very rapidly. I have at any rate seen no specimens that I could unhesitatingly refer to the typical form south of Belgaum and Raipur.

In *Nidification*, iii, 452 Mr. Stuart Baker can only record reputed breeding places of the Alpine Swift in India. It is well to emphasise therefore that James Davidson took a half-feathered chick, now in the British Museum, at Saptashring, Nassik, on 11 April 1887, while Rattray caught a young bird at a nest near Dunga Gali (*J.B.N.H.S.*, xvi, p. 660).

[**Micropus pacificus leuconyx** (Blyth).

Cypselus leuconyx Blyth, J.A.S.B., vol. xiv (after July), 1845, p. 212—Deccan.

Jerdon states that he obtained a specimen of the White-rumped Swift in the western part of the Deccan and several in Malabar (*B. of I.*, vol. i, p. 180). This record was viewed with some suspicion in both the *Old* and *New Faunas*, but there seems no reason to discredit it in view of John Davidson's experience of its abundance along the coast in North Kanara (*J.B.N.H.S.*, xii, p. 47). It is therefore not unlikely to visit the Presidency and Baker and Inglis (*Birds of S. India*, p. 192), indeed, state that it occurs in the Nilgiris where it may sometimes be seen in company with *M. affinis* and *M. melba*. It should not however be definitely admitted to the Presidency list until specimens have been procured for proper identification.]

Micropus affinis affinis (Gray).

Cypselus affinis Gray, Illustr. Ind. Zool., vol. i (March 1830), pl. 35, fig. 2—Ganges.

Specimens collected:—589 ♂ 23-7-29 Gingee; 811 ♂ 12-9-29, 819 ♀ 27-9-29 Kodur; 872 ♂ 3-10-29 Seschachalam Hills 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	8-10	122-125.5	39-40.5	9 mm.
1 ♀	8.5	123	37.5	— mm.

The Common Indian Swift has not been recorded in the Presidency from anywhere north of the Krishna River. South of that it occurs at Bellary where Captain Horace Terry wrote about a possible connection between its breeding habits and the rains in June and later (*N. & E.*, iii, 23). The above Survey specimens and Dewar's remark that it is not very frequently seen at Madras complete the records for the eastern side.

In Coorg, according to Betts, it is fairly common but its numbers vary greatly. One day it may be seen in large flocks and then it disappears for several weeks. It apparently does not breed in Coorg.

William Davison records (*S.F.*, x, 347) that he saw it at Ootacamund on several occasions in January as also Baker (*Birds of S. India*, p. 192). Betts informs me that in his experience it is not common in the Nilgiris though flocks may be seen occasionally along the edge of the Ghat, especially in the evening.

In the Nelliampathies Kinloch only found it on the Lily downs where it was fairly common (*J.B.N.H.S.*, xxix, 565).

As regards the Palnis, Fairbank tells us that he saw a dozen hawking at 3,000 ft. Terry, however, found it not uncommon at Pittur and Kukal.

In Travancore Ferguson says that he did not meet it himself though his collectors found a colony breeding in January 1903 in the Registrar's office in N. Parur.

The only breeding records for the Presidency are mentioned above and here, as in many other parts of India, there is considerable difficulty in understanding the status of this Swift.

There are few birds which have given more trouble to the taxonomist than this Swift. The questions of the identity of Indian and African birds and of the division of Indian birds into races have been discussed on many occasions. Unfortunately the Survey did not profit by the chance of obtaining a good series in the south from whence birds are most needed.

In the *New Fauna* (vol. iv, pp. 332-335) Stuart Baker divides Indian birds as follows (the wording of the distributions is his):—

Micropus affinis galilejensis—Sind and portions of North-West Provinces.

M. a. affinis—North-West Provinces except along the Afghan and Baluchistan boundaries: Punjab, United Provinces, Bihar, extreme Western Bengal, south to Belgaum, Rajputana, Deccan and Central Provinces.

M. a. nipalensis—Nepal, east to Kamrup in Assam and Bhutan; Bengal, Duars, Orissa to Madras; South Deccan, Southern Bombay Presidency from a little south of Belgaum, Mysore and Travancore.

M. a. subfurcatus—Assam; Chittagong and Comilla in Eastern Bengal, Manipur.

This division is certainly not satisfactory as a whole.

M. a. affinis and *M. a. subfurcatus* are of course two perfectly good and recognisable races and they were in fact regarded as two species in the *Old Fauna* (vol. iii, pp. 168-170). *M. a. subfurcatus* differs from the typical race in having the head, nape, wings and tail and the tail-coverts blacker so that there is less contrast between them and the mantle and back. The tail is longer and distinctly subfurcate.

M. a. galilejensis (type-locality Galilee, Palestine) is very similar to *M. a. affinis* in that the tail is short and there is a distinct contrast between the head and nape and the mantle. It is merely a paler and larger form of it. The palest parts of the head, namely the forehead and a short connected superciliary streak, may become almost white. Wing 132-137.5 mm., tail 40-45.5 mm.

This form is however only recognisable if a series of Palestine birds is compared with a series of South or Central Indian birds. Individual specimens cannot always be recognised and I certainly cannot find any value in attempting to maintain a distinguishable distribution of *M. a. galilejensis* in N.-W. India.

A series from the Punjab in Mr. Waite's and my own collections measures:—

	Wing.	Tail.
9 ♂	125-133.5	39-44
13 ♀	127.5-132.5	38-43

This series is quite indistinguishable in colour from the Survey series and other birds from Central and Southern India. It is however slightly larger. Mr. Bannerman (*Ibis* 1932, p. 687) measures 22 examples of *affinis* as having wings 112-134 mm., seldom over 130 mm. In 11 examples of *affinis* measured from Bombay southwards—leaving aside the Survey series—I find a variation of wing 124-130.5 mm., tail 38-41.5 mm. except for one bird with a wing of 116 mm. We may accept the fact that a slight grading in size from north to south exists but it is not marked enough for racial recognition. Southern Indian birds are as much smaller than Northern Indian birds, as these latter are than true *galilejensis* from Palestine. They are as close in colour to North Indian birds as these latter are to true *galilejensis*. The intergradation between the three areas is complete and it is therefore as illogical in theory as it is in practice valueless to place the division between the two forms somewhere in N.-W. India instead of between Palestine and India. In my opinion *galilejensis* may be removed from the Indian list.

There remains the question of *M. a. nipalensis*. This form is the intermediate between *M. a. affinis* and *M. a. subfurcatus* both in colour and size (Nepal wing 127.5-133 mm., tail 44-48 mm.). It may be recognised if desired in this sense but I find no evidence whatever for including with it birds from Orissa, Deccan and the Madras and Bombay Presidencies, which in my opinion are quite indistinguishable from *M. a. affinis*.

Stuart Baker has however commented on the fact that birds from Ceylon are dark. This is correct. The three specimens in the British Museum are alike in having the head, tail and upper tail-coverts all practically black, almost the same colour as the mantle. In other words they agree in colour with *subfurcatus* rather than *affinis*, though they differ from the former in their smaller size (wing 128-132.5 mm., tail 42-43.5 mm.). They certainly cannot be included with *M. a. affinis.* It would be dogmatic to pronounce on their identity until a better series is available but the probability is that they are identical with the African *M. a. abessynicus*. The only two specimens which I have examined from Travancore agree with Ceylon birds rather than true *affinis*.

Cypsiurus parvus batassiensis (Griffith).

Cypselus balassiensis (error for *batassiensis*) Griffith in Cuvier's Animal Kingdom, vol. vii (*Aves*, vol. ii), 1829, p. 60—India, restricted to Calcutta.[1]

Specimens collected:—5-6 ♂ ♀ 9-4-29 Kurumbapatti; 1722 ♂ 23-4-30 Jeypore Agency 2,000 ft.

Measurements:—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
2 ♂	7.5-8.5	115-120	30.5-32	60-61	28-30.5 mm.
1 ♀	8	114.5	31	61	28 mm.

The Palm-Swift is doubtless generally distributed throughout the Presidency wherever the *Tad* Palm (*Borassus flabellifer*) is found. Where that may be I find but few details. Jerdon's statement that the Swift is common in the Northern Circars and Carnatic and Dewar's statement that it is very common at Madras furnish the only records for the eastern side in addition to the three Survey specimens.

On the west, Hume stated that he had received a specimen from Sultan's Battery, Wynaad (*S.F.*, x, 348). Fairbank observed it about *Tad* Palms in Periakulam near the eastern base of the Palnis. It is very abundant in South Travancore where its host palm takes the place of the cocoanut in the low country about Cape Comorin, extending in smaller numbers as far north as Trivandrum and Quilon. In this last area it is said to breed from February to June. It is evidently a strictly resident species.

Stuart Baker has divided the Palm-Swift into two Indian races, the typical race in his opinion occurring from Bengal and Upper Assam, through Orissa and Madras to Ceylon, whilst the rest of the Indian range (which as Ticehurst has pointed out, *J.B.N.H.S.*, xxxiv, 473, is more restricted than Stuart Baker realises) is given to a paler race *palmarum*. Specimens of this Swift are not numerous in collections and a large proportion are poor and greasy so that I have had great difficulty in assuring myself that this division is correct. One would hardly expect it. In the first place this Swift is so definitely a parasite[2] on the *Borassus* palm that its limited habitat and the restricted range of the palm in India, which is no doubt based on uniformity of certain ecological conditions, would hardly be expected to allow the formation of races. While, secondly, birds which have a very wide range outside India do not as a rule tend to break up into races in India. In my opinion we can only consider *batassiensis* and *infumatus* as races of the widely spread African Palm-Swift *Cypsiurus parvus*, which is also a parasite on certain palms and particularly on *Borassus flabellifer*.

Chaetura giganteus indicus Hume.

Chaetura indica Hume, Stray Feathers, vol. i (1873), p. 471—Andamans.[3]

The Brown-throated Spine-tail was not reported by the Survey. It is however very numerous in parts of the Presidency, though its movements are not easy to understand.

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[1] Stuart Baker, *New Fauna*, iv, 336.

[2] A slight misuse of this term may perhaps be forgiven. The Swift does not of course feed on the palm.

[3] For the use of the generic name *Chaetura* and not *Hirundapus* see Steinbacher Die Vögel der paläark. Fauna, Ergänzungsband Heft. iv, p. 356. The type-locality for *indica* was restricted to Aneichardi, Travancore by Stuart Baker (*J.B.N.H.S.*, xxviii, p. 322) but unnecessarily as Hume (*loc. cit*) clearly mentions the Andamans as his first locality.

In Coorg it is not very common, according to Betts, being found in small parties. Jerdon says that he met with it very frequently in the Wynaad and at times on the seacoast of Malabar. Once, sometime after sunset he saw an enormous flock pass over the bungalow at Canote, about 14 miles from the coast at Tellicherry. They were flying nearly due west towards the sea (*B. of I.*, i, 172). He first met with it at the foot of the Nilgiris near Metapolliam and again at Goodalore on the western side of the hills. Vipan (*S.F.*, i, 496) reports that he shot it on the Coonoor Ghat. William Davison (*S.F.*, x, 347) is more detailed. On the Nilgiris and their slopes, according to him, this Spine-tail occurs at odd intervals, in parties of 12 to 50 individuals. They generally arrive from the east and disappear westwards. This statement agrees with the experience of Mr. H. R. T. Carter at Coimbatore (*S.F.*, i, 474), who found that the Spine-tails were accustomed to pass over in a line from the Anamallais over the Palghat gap to the Nilgiris, travelling very fast. His account is too long to be quoted here and it is not altogether clear but he evidently considered that the passage was seasonal and apparently dependent on the S.-W. Monsoon. June, July and October are mentioned and birds collected in those months are in the British Museum.

In the Nelliampathies Kinloch says that this species is common in the cold weather. In spite of this statement and Mr. Carter's experiences I do not think that the bird is a migrant in the true sense and its spectacular movements are probably dependent on meteorological conditions. North Kanara is the northern limit of its recorded distribution in Southern India (*J.B.N.H.S.*, xii, 48), James Davidson considered it a resident and in Travancore, Bourdillon (*S.F.*, vii, p. 34) clearly says that it is abundant at all times of the year when the weather is fine and clear though during the early showers of April a flight of Swifts is a pretty sure indication of the approach of a storm. The breeding season in Travancore is almost confined to March and April (see Stewart, *J.B.N.H.S.*, xxii, p. 393 and *apud* Stuart Baker, *Nidification*, iii, pp. 465-467) and most nests are to be found at elevations between 1,000-2,000 ft. in thick forest. These Swifts roost in colonies in trees but the circumstances of their breeding in the base of hollow trees separates the pairs at that period.

Although largely confined to the rain forests of the western hills it is not surprising that this Swift travels to the east of the Presidency on occasion, as Carter mentions (*loc. cit.*) that he had seen it at Salem and further north Hume mentions specimens from Bangalore (*S.F.*, x, 347).

The statement in the *New Fauna* (iv, 343) and *Nidification* (iii, 465) that the northern limit of this Swift in Southern India is latitude 12° is of course a slip. It is common in North Kanara.

Indicapus sylvaticus (Blyth)

Acanthylis sylvatica Tickell, J.A.S.B., vol. xv (1846), p. 284—Central India—restricted to Maunbhum.

Not obtained by the Survey. Very little is known about the White-rumped Spine-tail in our area. William Davison met a party hawking about over a stream on 1st May in the Peria forests of the Wynaad and a specimen that he obtained on that occasion is in the British Museum. It has been recorded from Coonoor (*Old Fauna*, iii, 175) but it must have been only a straggler there as no one appears to have met it again in the Nilgiris. I cannot trace the authority for the statement in the *New Fauna* (iv, 345) that it occurs in the Palnis.

In Travancore this Spine-tail was apparently overlooked by the Bourdillons and Ferguson and it was first recorded by Mr. J. Stewart (*J.B.N.H.S.*, xxii, 394) who says 'breeds on the Travancore Hills in open forest at elevations of about 2,000 ft. It hawks about during the day in parties of about a dozen birds, but does not breed in colonies'. Mr. Stewart was also successful in obtaining nests and accounts of the breeding habits in Travancore will be found in the *New Fauna*, iv, 146 and *Nidification*, iii, 345. The breeding season is in March and April and Stewart obtained a few eggs in the first half of May.

There are no races of this bird in India and the very similar *Rhaphidura leucopygialis* (Blyth) can hardly be considered a race of it owing to the elongated upper tail-coverts, which are paralleled by *Chaetura sabini* of West Africa. Mention should however be made of the fact that *Chaetura thomensis* Hartert, restricted to the island of Sao Thomé in the Gulf of Guinea, would certainly pass on its characteristics as a race of our Indian bird. The genera of these Swifts are evidently in need of revision.

Collocalia fuciphaga unicolor (Jerdon).

Hirundo unicolor Jerdon, Madras Jour. Lit. Sci., vol. xi (1840), p. 238—Coonoor Pass.

Not procured by the Survey as in the Presidency it is confined to the western side. The Indian Edible Nest Swift is the commonest Swift on the western hills where it is evidently a resident. In Coorg according to Betts it is always present in large numbers. William Davison mentions it as very abundant in the Brahmagherries while Jerdon includes the Wynaad in its range. In the Nilgiris it is of course very well known, especially about Ootacamund. It must occur between all these hills and the coast as Jerdon has left an account of the breeding colony on Sacrifice Rock, 20 miles south of Tellicherry, which he visited in March 1849 (*N. & E.*, iii, 29).

It is found in large numbers in the Palnis, especially about the lake at Kodaikanal and Foulkes (*J.B.N.H.S.*, xv, 727) gives an interesting account of how these Swifts dip into the water as they fly, occasionally with sufficient violence to be upset and drowned.

It is similarly abundant on the hills of Travancore.

The breeding season is somewhat extended from March to June and we have more detailed accounts of the breeding of this Swift than of almost any bird in the Presidency. The chief references for it are *Stray Feathers*, iv, 374 (Bourdillon), *Nests and Eggs*, iii, 28-33 and *Nidification*, iii, 468.

Dr. Stresemann has devoted special attention to the difficult group of these Swiftlets and his latest conclusions will be found in *Bull. Raffles Museum*, No. 6, December 1931. I do not therefore propose to go into the affinities of this species in any detail. I should however like to remark that in my opinion it is quite incorrect to attribute the Himalayan and the South Indian forms to two different species. They are evidently two races of one species. In colour they are identical except that the Himalayan bird *C. f. brevirostris* (McClell.) is a shade darker and more glossy on the upper plumage and it is also slightly larger:—

		Wing.	Tail.
C. f. brevirostris	7 ♂	121-131.5	51.5-58 mm.
C. f. unicolor	6 ♂	113-117	47.5-54.5 mm.

It is commonly stated that *unicolor* has the tarsus naked and *brevirostris* feathered. If this is correct—and I am aware that Hume believed in it (*S.F.*, ix, 289 and xi, 33)—the difference is certainly not appreciable in skins and at best is so slight that no great importance need be attached to it. It is valueless for a key.

The reason for keeping *unicolor* as a separate species to *brevirostris* has no doubt been the belief that both forms occur in the Western Himalayas. This is based solely on a small series of *unicolor* in the British Museum, labelled Koteghar 1868. These skins are not very satisfactorily labelled and one of them has had Koteghar substituted for Etawah. It may be that Koteghar has somehow been confused with Kotagiri or the skins have been wrongly labelled for some other reason. At any rate I am personally quite satisfied that only one form of Swiftlet occurs in the Western Himalayas and it is undoubtedly *brevirostris*. This point should materially assist Dr. Stresemann's further studies of the group.

Attention may be directed to the remarkable development of the salivary glands in the breeding season, connected with the curious nesting habits.

Hemiprocne coronata (Tickell).

Hirundo coronata Tickell, J.A.S.B., vol. ii (November 1833), p. 580—Borabhum.

Specimens collected:—269 ♂ 23-5-29, 279 ♀ juv. 24-5-29 Shevaroy Hills;

735 ♀ 23-8-29, 744 ♀ 24-8-29 Palkonda Hills 1,000 ft.; 1667-8 ♂♀ 6-4-30 Sankrametta 3,500 ft.; 1691 ♂ 17-4-30 Jeypore Agency 3,000 ft.

Measurements:—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
3 ♂	12-13	141-156	41-45.5	119-135.5	7-8.5 mm.
3 ♀	11	150.5-159.5	40.5-45	126.5	7-8 mm.

The Indian Crested Swift has not been recorded from the eastern side of the Presidency except for the above Survey specimens and Jerdon's remark that he had got it from the Nellore Ghats. It is not very common on the west either. Mr. Betts did not include it in his Coorg list, though he later informed me that a pair had been seen about some paddy fields on several occasions until the monsoon apparently drove them away. William Davison met them occasionally in the Wynaad but not in the Nilgiris. They occur there however as Jerdon says that they extend up to 4,000 ft. and Hume (*N. & E.*, iii, 36) mentions that he received eggs from the Nilgiris.

Kinloch found the Crested Swift in the Nelliampathies in the cold weather. In the Palnis Fairbank says he only met with a single immature specimen at the eastern base and this specimen (♂ juv. 25-6-1877) is now in the British Museum. Terry, however, considered it pretty common on the slopes of the Palnis and at Pulungi, and he obtained a single much incubated egg in the Pittur Valley on 7 April. The taking of this nest is described at length in *N. & E.*, iii, p. 37.

In Travancore Ferguson considered it by no means common, remarking merely that the museum contained a few specimens without locality and that he had only had one brought in by his collector.

Terry's nest furnishes the only breeding record for the Presidency and the bird's status does not appear very clear.

The Crested Swift has no races in India. Nothing is known about the meaning of the patch of silky downy feathers on the flank or of the curious decomposed edges to the tertiaries which in some specimens make a conspicuous patch.

Caprimulgus macrourus atripennis Jerdon.

Caprimulgus atripennis Jerdon, Illus. Ind. Orn. (March 1845), letter press, pl. 24—Eastern Ghats to west of Nellore.

Specimens collected:—335 ♀ 5-6-29, 439 ♀ 18-6-29 Chitteri Range 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♀	20-21.5	174.5-179	123.5-127	16-18.5 mm.

Very little is accurately known about this race of Horsfield's Nightjar in the Presidency. Jerdon obtained his type, which is still in the British Museum, from the Eastern Ghats, west of Nellore, and Roscoe Allen met with the species at Horsleykonda in April (*J.B.N.H.S.*, xviii, 905). LaPersonne reported some species of Nightjar to be very common throughout the district of Salem and the two specimens procured, one of which was killed from a nest with one egg, both belonged to this species.

In Travancore Ferguson only procured two specimens, both of which were shot on the High Range. Kinloch took a clutch of eggs in the Nelliampathies in February, according to Stuart Baker (*Nidification*, iii, 479), but the species is not included in Kinloch's published list of the birds of those hills and as on p. 482 Kinloch is also credited with having obtained the eggs of the large Northern race *C. m. albonotatus* in the same hills it is evident that these records require some confirmation.

Further north William Davison says that he only met with it at Manantoddy, Wynaad, and in that immediate neighbourhood and this record is verified by two skins in the British Museum. He adds that it does not seem to occur on the Coonoor, Neduvattum or Seegore side of the Nilgiris, but that it occurs below Kotaghery. A female obtained in the last locality by Miss Cockburn on 15 April 1871 is in the British Museum.

Nothing appears to be known accurately about the breeding season in the Presidency.

Further northwards this race may be accepted as reaching to N. Kanara and the Godavery Valley. On the eastern side it gradually grades into the larger *albonotatus*.

In the *New Fauna* Mr. Stuart Baker accepts Ceylon birds as belonging to *C. m. atripennis*. This, however, does not appear to be correct. There is a good series of specimens from Ceylon in the British Museum and they are definitely darker in tone throughout the whole upper surface, this being particularly marked on the collar, which is chocolate as opposed to rufous brown, and on the tails.

The series from Java in the British Museum is very poor but so far as it goes I am unable to see any difference between Ceylonese and Javan birds and, therefore, attribute the former to the typical form, thus providing another example of the close connection between the Cinghalese and Malaysian faunas.

The only description[1] which I can find of the call of this race is by James Davidson (*J.B.N.H.S.*, xii, 50) who says it is an almost metallic cry of four notes. This would seem to be confirmed by Butler's remark (*J.B.N.H.S.*, xii, 423) that the Ceylon form has also a call which is 'invariably a low liquid chuckle of three or four notes'. But there may be some mistake as Legge says that the call of the Ceylon bird resembles the sound of striking an axe on a thin plank, a call which is very definitely known to belong to other races of this species.

It should be remarked that an important difference between birds from Northern India (*albonotatus*) and birds from Southern India (*atripennis*) and Ceylon (*macrourus*) appears to have been overlooked. In the first named the females have the tips of the outer tail feathers pale yellowish buff, so that they are easily distinguished from the male. In the other two races the tips are normally white as in the males.

Caprimulgus macrourus albonotatus Tickell.

Caprimulgus albonotatus Tickell, J.A.S.B., vol. ii (after December 1833), p. 580—Borabhum.

Specimen collected:—1771 ♂ 5-5-1930 Anantagiri 3,000 ft.

Measurements:—

Bill.	Wing.	Tail.	Tarsus.
22.5	210	169	20.5 mm.

This specimen provides the first record of this race of Horsfield's Nightjar in the Presidency and, according to LaPersonne, it was common throughout the hills of the Vizagapatam district. The testes were very greatly enlarged, so it is evident that the breeding season here includes May.

I am not able to follow Stuart Baker (*New Fauna*, iv, 364-365) in his division of this Nightjar in Northern India into two forms. Birds from the Eastern and Western Himalayas appear to me to be identical in colour and size and with them must be grouped the winter series from the United Provinces. They run only slightly larger than the small series of birds available from the Chota Nagpur area. These topotypical birds are in truth intermediates between the large pale birds of Northern India and the small dark *atripennis* of the south, but as they are far closer in size to and agree in colour with the northern birds they may well give their name to the whole area. I have seen no evidence for the extension of the range of this race, or indeed any race, to the Northern Bombay Presidency.

The note of Horsfield's Nightjar is well established. Long ago I wrote (*Ibis* 1926, 747) 'the call of this bird is a very loud resonant *chaunk* freely repeated, like the blows of an adze on a plank, or even the sound of felling a tree. It is audible a great distance away and when heard close at hand emits a great volume of sound. It is uttered from the bare branch of a tree.' B. B. Osmaston says 'its loud reverberating call *chounk chounk* . . . . repeated any number of times from 1 to 50 . . . This call is repeated at the rate of 5 in 4 seconds' (*J.B.N.H.S.*, xxvii, 949). Mr. A. E. Jones considers it a rich double call note *chaunk-chaunk* which reverberates through the jungles. He confirms that the call is only given from a bush or tree (*J.B.N.H.S.*, xxix, 286).

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[1] There has been and still is so much confusion over the calls of the various Indian Nightjars that it has seemed to me useful to summarise such accurate information that I can find on the call of each species.

Caprimulgus indicus indicus Latham.

Caprimulgus indicus Latham, Index Orn., vol. ii (1790), p. 588—India.

The Jungle Nightjar was not procured by the Survey and in the Presidency it is as yet only recorded from the western side except for Jerdon's statement that he procured it in the Carnatic.

In the Wynaad it occurs sparingly according to William Davison who considered it common on the Nilgiris. Here Jerdon says it occurs on the summits but Mr. Betts informs me that it occurs all over the hills. Kinloch is said to have taken eggs in the Nelliampathies (*Nidification,* iii, 484). Terry says that it is common in the Palnis, especially at Pulungi and Pittur; at the latter place their calling was a positive nuisance to the camp.

In Travancore it is common and Bourdillon considered it a winter visitor but Ferguson has corrected this. In his opinion it is a winter visitor to the lower slopes of the hills, apparently retiring about May to the High Range.

In the Nilgiris William Davison gives the breeding season as the latter end of February and the earlier part of March. At Kotaghery Miss Cockburn considered it February, March and April. In the Nelliampathies Kinloch's eggs were taken in February. In Travancore Bourdillon says it breeds from January to March.

There are two points on which I am unable to agree with Stuart Baker (*New Fauna*, vol. iv, pp. 366-369). First of all I cannot agree to the extension of the Ceylon race *C. c. kelaarti* to Southern Travancore. There are only three specimens from Ceylon in the British Museum and these may just be separable from the typical race on their smaller size (2 ♂ wing 174-180 mm., tail 126 mm.; 1 ♀ wing 174 mm., tail 116 mm.) and on having the tail darker with heavy barring, though a better series may prove that this distinction does not hold good. Travancore birds however—and of these I have examined quite a good series—do not appear to me to be separable from those throughout the rest of Peninsular India either in size, in the prevailing grey tint of the plumage, the finer streaking of the back or in the finer barring of the tail. There is of course a good deal of individual variation but as Hume showed long ago (*S.F.*, iv, 381 and vi, 56) it is not consistent with distribution.

Himalayan birds are, however, separable from those of the Peninsula. In a series the general tone of colouration is warmer and browner, the markings on the back are heavier and the barring of the tail is broader. Whilst not absolutely larger in a series, as individuals they tend to average larger.

These Himalayan birds Stuart Baker attributes to *Caprimulgus indicus jotaka* Temm. & Schl. (Japan) and this is the second point on which I differ from him. In my opinion Japanese birds—if Himalayan and Japanese are compared in a good series—are a much colder, more smoky grey in colour, with the upper parts more uniform and less heavily marked especially on the mantle and tertiaries. The lower tail-coverts are usually unbarred and the white patch on the outer tail feathers is usually further from the tip of the tail. There appears to be no existing name applicable to Himalayan birds and so I propose to call them

Caprimulgus indicus hazarae subsp. nov.

Type in the British Museum. ♂ 3 May 1871 Abbottabad, Hazara (A. O. Hume).

East and West Himalayan birds are identical.

There are three specimens from Hazara in the British Museum as well as specimens from the Simla and Mussoorie Hills so Stuart Baker is wrong in giving Kumaon as the western limit in the Himalayas. It is doubtless a slip that in *Nidification* (iii, 483-484) *indicus indicus* is given as breeding round Naini Tal, while *indicus jotaka* is said to breed in Kumaon.

There seems to be little doubt about the call of this species which is very noisy and a good idea of it will be obtained from the different versions that have been given. Butler (*S.F.*, iii) says it is 'loud and peculiar, resembling the words chuck chuck chur-r-r repeated several times continuously. James Davidson says that it is either 'tuk' 'tuk' constantly repeated or this with an occasional 'tukkoo' 'tukkoo' (*J.B.N.H.S.*, xii, 50). Whitehead considered it 'cuckoo' (the *u* pronounced like the *u* in luck) and said that it was used by both sexes (*J.B.N.H.S.*, xxi, 166). B. B. Osmaston goes into more detail:—'its call is of two kinds. Firstly a monosyllabic, chuck, chuck, chuck . . . repeated about half a dozen times at the rate of 5 'chucks' in 2 seconds. It has a second call, not so commonly heard, which is made up of dissyllables 'chucker-chucker-chucker'—repeated at the same rate as the first call (*J.B.N.H.S.*, xxvii, 949). With this description A. E. Jones concurs, adding that the males utter a soft not unmusical note 'you-you-you' while chasing another bird, probably the mate (*J.B.N.H.S.*, xxix, 286). Finally Mr. Salim Ali (*J.B.N.H.S.*, xxxvii, 138) says that 'the call is usually uttered from the branch of a tree on which the bird crouches lengthwise. The notes I have likened to water dripping on water (but much louder) at the rate of about 2 drips, a second, connected as it were by the echo of the dripping; *chuck-ko, chuck-ko, chuck-ko* and so on'. This recalls Legge's version of long ago *chump-pud, chump-pud*, repeated for several minutes.

Caprimulgus monticolus monticolus Franklin.

Caprimulgus monticolus Franklin, P.Z.S. 1830-31 (October 25, 1831), p. 116—Ganges between Calcutta and Benares and in the Vindhyian Hills between the latter place and Gurra Mandela on the Nerbudda.

Franklin's Nightjar was not observed by the Survey and there appear to be only three records of it in the Presidency. There is a male in the British Museum collected by Blanford fifty miles north of Ellore on 11 February 1871. Jerdon (*B. of I.*, i, 199) says that he obtained a specimen at Nellore. A female collected by Surgeon-General Fry in Travancore is in the British Museum. The status is of course unknown. So far as I can see there is only the one race of this Nightjar in India. Stuart Baker [*Bull. B.O.C.*, li, No. cccl (April 1931), p. 102] separated birds from Sikkim to Eastern Assam, Burma, etc. as *Caprimulgus monticolus burmanus* but he has presumably since given up this race as it does not appear in *Nidification*, vol. iii.

There need be no difficulty in identifying the call of this Nightjar which is very distinctive and once heard cannot be mistaken. Osmaston (*J.B.N.H.S.*, xxvii, 949) described it as a 'rather sharp penetrating note like "choo-ee" uttered on the wing'. I considered it 'like a loud grating chirp, which close at hand resolves itself almost exactly into the sound of a whiplash cutting through the air' (*J.B.N.H.S.*, xxviii, 284). Jones calls it 'a loud piercing "chweep" ' (*J.B.N.H.S.*, xxix, 286), and Waite repeats Mr. Osmaston's description (*J.B.N.H.S.*, xxxi, 821). Salim Ali (*J.B.N.H.S.*, xxxvii, 138) calls it a 'loud penetrating call of a single note "sweesh" '. It is uttered both from the ground and on the wing and sometimes from the top of a bush. In the pairing season it may be heard all night long, before dark and after dawn. When flushed during the day the bird gives a low chuckle.

In the interests of accuracy it may be as well to leave on record the fact that the specimen of *Caprimulgus mahrattensis* recorded from Gorakhpur (*J.B.N.H.S.*, xxii, 541) is really a juvenile of *Caprimulgus monticolus*. It is in my collection together with the rest of Mr. A. E. Osmaston's skins.

Caprimulgus asiaticus asiaticus Latham.

Caprimulgus asiaticus Latham, Index Ornith., vol. ii (1790), p. 588—India, Bombay.

Specimen collected:—876 ♂ 5-10-29 Seschachalam Hills 2,000 ft.

Measurements:—Bill 19 mm., wing in moult, tail 105 mm., tarsus 19 mm.

The above specimen provides the only reliable record of the Little Indian Nightjar on the eastern side of the Presidency. On the west there are more records. Betts tells us that in Coorg it is very common and that numbers may be seen sitting on the roads at night, their eyes showing up in the headlights of cars as ruby specks. As, however, he mentions no other species this record no doubt refers in part to other species as well.

Fairbank obtained a single specimen, now in the British Museum on 5 June 1877 at the eastern base of the Palnis and remarks that it was the only Nightjar seen or heard in five weeks.

In the low country of Travancore it is very common according to Ferguson. Nothing has been recorded about the breeding season in the Presidency.

I have not been able to understand the division of this Nightjar into races satisfactorily. There are at any rate three colour phases, pale sandy, brown and grey and there appears to be some correlation of these phases with locality, the pale sandy birds coming from the North-West, the grey birds from the Deccan and the brown birds from other localities. The phases, however, so grade into each other and there seem to be so many exceptions to their connection with special localities that I hesitate to consider these colour phases as definitely subspecific.

Parrot, *Orn. Monatsb.,* 1907, p. 170, separated birds from Ceylon as *Caprimulgus asiaticus minor* on the ground of size. Ceylon birds are very small; wing in males 141.5-145 mm. whereas males from North-Western India measure 144-156 mm. There is complete intergradation between these two extremes though birds from Travancore and Mysore appear to be as small as those from Ceylon. Until I have seen more specimens, to determine these questions of colour and size, it seems more satisfactory to attribute all Indian birds to the typical race, accepting *minor* as the insular race.

The call of this species is well known and fully authenticated. It is often compared to the sound of a stone skidding quickly across ice. James Davidson (*J.B.N.H.S.*, xii, 50) syllabilises it as *tuk tuk tuk tookmaluk* but I think most people would prefer the rendering *chak chak chak char-r-r-r* (B. B. Osmaston, *J.B.N.H.S.*, xxvii, 949) or *tuk tuk tuk tukeroo* of the *Fauna.*

Lyncornis macrotis bourdilloni Hume.

Lyncornis bourdilloni Hume, Stray Feathers, vol. iii (1875), p. 302—Kalland Khauni, S. Travancore.

In Southern India the Great Eared Nightjar is entirely confined to Travancore and there is really very little on record about its actual distribution. The type was obtained on the 15th January at Kalland Khauni on the banks of the Peenaven-aur, about 15 miles north of Mynall at 600 ft., and Bourdillon then gave some note of its habits. His next communication on the subject in a letter to William Davison will be found in the *Ibis* for 1888, pp. 146-7 with reference to meeting it at Konegur. Ferguson's account appears to have been merely taken from Bourdillon and what little more we know about it is due to Stewart (apud Stuart Baker, *New Fauna*, iv, 375 and *Nidification,* iii, 490). It is there said to be confined to Central and South Travancore and to be moderately common from sea-level up to 2,000 ft.

The principal nesting months are February and March, but Stewart took eggs from the first week in January to the 1st of May.

In Tenasserim, William Davison found that this Nightjar spent the day in caves (*S.F.*, ix, 151), but this habit has not yet been noted in Travancore.

The 'wailing call' of the male as mentioned in the *New Fauna* is probably that described by Davison (*loc. cit.*)—'a full clear whistle which can be heard a very long distance off; it might be syllabilized two-wee-oo, each syllable lengthened out but specially so the middle one. Occasionally the first syllable is double and shortened too-too-wee-oo; this whistle the bird repeats at irregular intervals, one calling and another answering.'

The Indian forms are evidently subspecies of *Lyncornis macrotis* (Vigors) of the Philippines as pointed out by Hachisuka (*Birds of the Philippines*, Pt. III, p. 114).

Batrachostomus moniliger Blyth.

Batrachostomus moniliger Blyth, J.A.S.B., xviii (1849), p. 806—Ceylon.

The Ceylonese Frogmouth was not met by the Survey as it is confined to the South-Western Ghats and Ceylon. The distribution given in the *New Fauna* (iv, 382) and *Nidification* (iii, 494) is not extensive enough. This species is common in North Kanara (James Davidson, *J.B.N.H.S.*, xii, 50).

In the Presidency it was seen in Coorg by Jerdon (*J.A.S.B.*, xiv, 209) who also tells us (*B. of I.*, i, 189) that Capt. Roberts of the 36th N. I. obtained it on the Peria Pass leading from Malabar into the Wynaad.

In Travancore according to Bourdillon (*S.F.*, iv, 376) it is not uncommon about 2,000-3,000 ft. elevation in the hills. Stewart (apud *Nidification*, iii, 494) says that it is most common at about 2,000 ft., occurring also up to 4,000 ft. and nearly down to the level of the plains. The normal breeding season is according to him from January to April, but odd eggs were taken from June to September.

The call does not yet seem to be properly identified. James Davidson (*loc. cit.*) attributed 'a wailing cry' to it. Bourdillon on the other hand (*S.F.*, iv, 376) considered it had a 'loud chuckling cry, with somewhat the tone of a Goatsucker and not unlike the laugh of some Kingfishers, a difficult cry to describe'. Legge agrees with this description as representing a call which he also attributed to this species. In the *New Fauna* the ordinary call is said to be a soft *kooroo-kooroo* repeated several times.

I have at present no reason to separate Indian and Ceylonese birds as the plumage is variable and I have only seen a poor series. The whole group appears to be in need of revision as regards the specific and subspecific arrangement of the various recognised forms.

(*To be continued*).

THE PAPAW TREE.

BY

J. F. CAIUS, S.J., F.L.S.

The CARICACEAE, natives of tropical America and Africa, are a small family of plants, including 4 genera and 45 species.

The family has been named after one of its genera, the genus CARICA. This generic name is derived from the Greek word *Karikos* which means *of* or *from Caria*, a province of Asia Minor, erroneously supposed at one time to have been the habitat of the papayads. The genus Carica numbers 30 species, inhabiting warm America.

The papayads are small trees, generally without branches. They have large palmately-lobed leaves, and on being wounded in certain parts they exude an acrid milky juice. Their flowers are borne in racemes proceeding from the bases of the leaf-stalks, the male and female flowers being usually on different trees. The male flowers have a funnel-shaped corolla, into the throat of which the ten stamens are inserted in two rows of five, one above the other; and the female flowers have a corolla of five distinct petals. The fruit is fleshy, and does not split open when ripe.

The most remarkable species is the PAPAW TREE, known to botanists as: *Carica Papaya*, Linn. Sp. Pl. 1036; *C. hermaphrodita*, Blanco, Fl. Filip., ed. i, 205; *Papaya Carica*, Gaertn. Fruct. ii, t. 122; *P. communis*, Noronha, in Verh. Batav. gen. v (1790), ed. i, Art. iv, 23; *P. cucumerina*, Noronha, loc. cit.; *P. sativa*, Tuss. Fl. Antill., iii, 45; *P. vulgaris*, DC. Poir. Encycl., v, 3.

OCCURRENCE.

Carica Papaya Linn. is considered a native of the West Indies, the shores of the Gulf of Mexico, and perhaps of Brazil. Its specific name 'papaya' is evidently American, whether derived from the Carib 'ababai' or not. The tree has now become acclimated in the hot regions of three continents; and the zone of most abundant growth seems to lie on either side of the Equator where the mean annual temperature is 77°F., provided soil and rainfall are favourable. It is grown by cultivation north and south of that zone. It is to be found throughout India, from Delhi to Ceylon; but it cannot be cultivated on the hills, except in the south where it is productive up to 4,000 ft.

It is quite common for numerous papaw plants to spring up from seeds scattered by birds over a portion of land which, according to tropical custom, has been cleared by burning away the trees and undergrowth. There are, however, no forests of papaws because the plants need sun and room. They are seldom seen among dense growths, nor do they propagate in clusters.

The papaw seems to be at its best in the rich humus of a hillside, and rarely takes to a swampy or sandy soil. It grows at the edge of the sea with the waves washing its roots; it prospers on the high mountain plateaus of all the windward and leeward islands; it flourishes—but does not attain to any great height—on the bare coral rocks of Yucatan; it thrives in the sandy soil of Venezuelan ravines, where rain averages one metre per annum and the climate is very equable; it grows prolifically without much cultivation or care in Peruvian valleys; it shoots up to a height of over one hundred feet in the trans-Andean regions; it appears spontaneously in waste places on the islands of Guam, where it receives but scant attention from the natives. However, those places seem best suited to the papaw where it does not rain but always pours, where daily rains abound throughout the year—pouring, soaking rains with a fierce bright sun shining all through the downpour.

CHARACTERISTICS.

Papaw trees present a striking appearance with their straight slim shiny trunks, and their bright green umbrella tops; but whether they are a thing of beauty is a matter of personal taste. 'This well known tree', says Woodrow, 'has been subjected to ill-merited abuse, described as ugly and everything that is disagreeable, yet it may be questioned if there is a more handsome or generally useful tree in Indian gardens.'

The Papaw tree suggests a palm in its habit of growth. It has a single, supple, slim, straight stem, terminating in a crown of large leaves, and branching only when its growth is interfered with. Cultivated plants attain a height of from 10 to 30 ft.; wild varieties push up to 60 or even to 100 ft. Near the base of mature trees the diameter ranges from 6 in. to 1 ft., the stem tapering gradually to about 4 or 5 in. at the summit. In a young plant the stem consists of a cellular pith filled with water; in a matured tree that portion of the trunk immediately under the bark is fibrous for a few inches, followed by a soft inner layer one inch or more thick terminating in the central portion which is hollow. At intervals through the hollow centre are to be seen membranous tissues dividing the cavity into sections, and in the rainy season, for a considerable height up the trunk, this central cavity is filled with water. The wood is soft, white and spongy; it cuts easier than a potato, so that the trunk can be chopped through by a single stroke of a cutlass; it is full of water, decays rapidly, and does not serve any useful purpose. The trunk is covered with a grey (green at the top) smooth, tough bark laid on in folds, which at intervals form ridges.

A large turnip-shaped tap root reaches deep down into the earth to seek nourishment and to give stability to the tree. This root is similar in structure to the trunk, except for a white bark, and possesses an odour of cabbage and a peculiar taste suggesting radishes.

The leaf-stalks diverge almost horizontally from the trunk; they are large and hollow, cylindrical toward the leaf and flattened at the point where they join with the stem. The leaves are frequently as much as two feet in diameter, deeply cut into broad lobes terminating in sharp points and having their margins irregularly waved or gashed; they are dark green on the upper and light green on the under side; they are shortlived and, as the tree shoots upwards, they drop off, leaving scarry marks on the bark of the tree trunk.

Pitcher formation was observed by Miss Mozelle Isaacs in the leaves of trees growing in the grounds of the Dadar Parsi Colony and of St. Xavier's College, both in Bombay. Pitchers may be best described as modified leaves; and as they only show during the monsoon, it has been surmised that they are due to the vigorous growth of plant life during that period and to the lack of the necessary space for them to develop into ordinary leaves. For in the process of pitcher formation, always found in female plants which usually have larger leaves than the male plants, new veins find themselves impeded from developing normally in the plane of the old leaf as all the available space is already occupied by many strong veins issuing from the same point; these new veins are consequently pushed upwards, and they develop into stalked simple leaves with a basal pocket.

Circumstances of climate, soil and cultivation may, however, so modify the characteristic features of the plant that discrepant descriptions and statements are on record. Among the notable varieties are the green and the violet papaw. This latter variety, which exhibits a purple stem and purple leaf-stalks, has had considerable attention paid to it and is more highly esteemed for cultivation. While young the trees are kept in the shade and pruned to prevent their growing tall; portions of the flowers are picked off to favour fruiting; and the smaller fruits are removed when green, so that the remainder may grow larger and stronger—indeed a fruit weighing 20 pounds is no rarity. The violet papaw is such a pliant plant that horticulturists boast of having produced a dwarf variety. But the green papaw is less adaptable; though it grows to a greater height, its fruit is smaller and possesses a less pleasant flavour.

The male tree produces long hanging clusters of narrow trumpet-shaped flowers having 10 anthers inserted on the throat of the corolla. The female tree bears single flowers with a white, yellow, or purple corolla of 5 sessile petals, and one pistil bearing a 5-rayed stigma. The female flowers grow in considerable numbers at the apex of the stem, which pushes rapidly upwards and puts out new leaf-stalks. Occasionally, bisexual flowers are produced by either male or female trees.

There is no definite flowering season, and the tree bears fruit all the year round. The fruit develops so rapidly that buds of flowers and ripe fruits are often found on a tree at the same time.

The fruit grows from the axils of the lower leaves, the normal fruit from the female flowers being sessile while that from the hermaphrodite flowers is borne on long pedicels. It varies considerably in form as well as in size, resembling an orange, or a gourd, or a cocoa pod, or a musk melon, or even a water melon. It is of a green or purplish colour turning yellow when ripe:

> 'The slim papaya ripens its yellow fruit for thee'—(Bryant).

Its skin is smooth and thin. The flesh of the green fruit is white, tough and watery; but as the fruit ripens its flesh becomes juicy and assumes a pinkish or orange hue, or turns to musk-melon yellow. The fruit has a central cavity which contains the seeds arranged in five lines along the whole length of it, and attached to, and held together by, a delicate membrane which constitutes the inner skin of the fruit. The fruit does not last long after ripeness sets in.

Miss Mozelle Isaacs has noted the presence of large white parenchymatous masses in the fruit of the papaw tree. She has also recorded the occasional appearance of long leafy structures: 'in some cases the funiculus is elongated, the integuments of the ovule absorbed in the elongation of the stalk, and the cotyledons and plumule of the seedling inside exposed giving the appearance of vivipary inside the fruit.'

Different names are sometimes employed to distinguish various forms of the fruit, as 'Ceylon', 'Madagascar', 'West Indies', etc.; these names are, however, misleading, for nowhere in the Eastern Tropics is the tree indigenous, and everywhere, as already stated, there occurs a good deal of variety as regards size and shape.

The seeds are of the size of small peas; about 230 when fresh go to an ounce, or 500 when partly dried. When fresh, they are dark brown changing to black on drying. Before desiccation their outer membranous coating is transparent and slimy; the inner coating is hard, horny and wrinkled; and between the two coatings there is a mucilaginous substance containing myrosin. The inner shell contains the leaf-like cotyledons, veined at the base with an albuminous homotropal embryo with a roundish radicle easily distinguished when slightly magnified. The seeds when dried resemble pepper-corns; they are aromatic, pungent, piquant—but not so sharp as mustard—and their taste slightly suggests water cress.

All the parts of the plant abound in milky juice or latex,, which is found most abundantly just under the skin of the fruit before ripening.

Hermaphroditism.

It is a common belief in the Gold Coast Colony that a male papaw can be made to bear fruits. This is done sometimes by cutting off the top of the male tree, which is then believed to produce fruit-bearing stalks. Another method is to make one or two holes right through the stem below the flowers, a stone or piece of wood being occasionally inserted to keep the hole open.

As a matter of fact the papaw plant is extremely variable in regard to its sexual characteristics. There are two extreme types —one strictly dioecious, the other monoecious—and many intermediate forms. In the strictly dioecious type, the fruit-bearing plant has pistillate flowers only, while the male plant produces almost exclusively staminate flowers in bunches towards the end of long peduncles: each flower has a rudimentary ovary and a style without stigma, being thus incapable of bearing fruit.

It sometimes happens that male trees produce hermaphrodite and pistillate flowers abruptly and unexpectedly. This monoecious type of plant bears fruit in every case; but the trees look from a distance as if they were female plants of the dioecious type. They generally produce two kinds of flowers, the one staminate and the other perfect. The perfect flower is quite different in shape from the pistillate flower of the dioecious type. Its ovary is much more elongated, being almost cylindrical. The stamens are usually placed on the inner walls of the petals midway down, with the anthers surrounding the lobes of the stigma. The fruit of this type differs from that of the dioecious type in the same way as the ovary, and is often called a 'long papaw'.

Another monoecious form is the plant in the process of changing its sex. It is not at all uncommon for a male plant, after producing staminate flowers for some time, to bear hermaphrodite flowers which in their turn are succeeded by pistillate fruit-bearing flowers. Miss Mozelle Isaacs has, moreover, witnessed the process of change exhibited by a female plant at Santa Cruz, near Bombay. She observed a fruit-bearing tree growing near a drain, changing its sex subsequently on the closing of the drain: the flowers became gradually smaller, lost their ovary, and began to appear in bunches on longer and longer branched inflorescences instead of singly in the axils of the leaves.

It has been repeatedly stated that the removal of the terminal bud causes male papaws to change their sex, and that trees treated at definitely recurring periods are the ones that exhibit this phenomenon. It is suggested that the plant has definite short cycles of growth and that it may be necessary to remove the top at some definite phase of this cycle in order to foster the development of fertile flowers.

To test the correctness of this statement L. B. Kulkarni selected a dozen male plants in the Ganeshkind Botanical Gardens, near Poona, and 'had their growing tips nipped off at the time of flowering. In a fortnight, there appeared a cluster of flowers round the cut portion; on examination eleven trees showed all male flowers, and one plant was found to have produced one hermaphrodite flower among clusters of male flowers. The male flowers on all plants were normal. The one hermaphrodite flower that was produced had five stamens attached to the base of the petals and placed round the syncarpous ovary. The fruit formed was a little oblong. This fruit dropped before ripening. The rest of the trees continued to produce male flowers on long peduncles as usual. The only effect of the pruning of the top was that the trees produced three or four branches.'

This finding supported that of the Hawaii Agricultural Experiment Station: 'It has been reported that staminate trees have been caused to produce pistillate flowers and fruit by beheading them. None of these means have proved to be successful from a practical standpoint.' It may, therefore, safely be concluded that the change of sex displayed by the male papaw does not appear to be in any way connected with the removal or retention of the terminal bud.

It would be puerile to attempt to describe all the intermediate forms which have been observed, for their name is legion and the difference among them is often trivial. However, mention ought to be made of two forms which, strangely enough, have been reported from such widely separated places as Ganeshkind and Hawaii. In the words of L. B. Kulkarni: '(*a*) One plant produced four types of flowers, namely: (1) staminate flowers, (2) and (3) two forms of perfect flowers, and (4) one form of pistillate flowers. The staminate flowers were exactly like those of the second or monoecious type above described. Of the two perfect flowers, one form corresponded precisely with that of the monoecious type, while the other had an ovary in shape like that of the pistillate flowers of the dioecious type. There were usually ten stamens attached to the base of the petals round the ovary in the first form—and only five stamens similarly attached in the second form. The pistillate flowers were exactly like those of the dioecious type.' '(*b*) Two plants bore only staminate flowers, but these flowers were carried close to the stem in the axil of the leaf. This is peculiar, as the trees usually producing staminate flowers have their flowers on long peduncles.'

There is, nevertheless, no doubt that the wild papaw in its natural habitat is unisexual. Sex perversion is one of the effects of migration and cultivation.

CULTIVATION.

Rusby has stated that this tree 'can be propagated and grown with great readiness, that its vitality is so great that it is with difficulty destroyed until its natural course has been run.' On the other hand six years' observation has convinced Kilmer that the papaw is exceedingly difficult of cultivation, and that the cultivated trees are most easily destroyed by adverse conditions.

The wild plants do not seem to be attacked by disease except after injury, but the cultivated plants are very susceptible to every sort of malady. Insects attack the tender leaves of the young plants and they wither. Fungi and bacteria find in the papaw suitable conditions for growing and multiplying, and they do grow and multiply at the expense of their host's vitality. After fruiting, and especially if the fruits are bled, the tree will suffer from general debility and become the prey of every adverse circumstance. And the trouble, whatever its nature, may be said always to arise from the inherent weakness of the cultivated plant in its altered environment.

It is, nevertheless, reported that in Ceylon, in Brazil, in Algeria and in the islands of La Reunion and the West Indies, successful and extensive cultivations have been carried out.

It is mentioned in the *Hawaii Agricultural Experiment Station Report* for 1911 that 'there is no means available for the propagation of the papaya by asexual parts, as cuttings, buds, scions, etc., hence seed varieties must be established by methods probably similar to those used in breeding varieties of vegetables and flowers which are not propagated by budding and grafting.' But Burns wrote in 1918: 'This excellent fruit is easily grown. It is propagated by seeds, but may also be propagated by cuttings.' And propagation by grafting has been tried with some success at Lucknow, at Ganeshkind, and also in the United States of America.

Propagation by cuttings or by grafting may perhaps not have yielded results which would commend it to the cultivator as a means to increase his harvest. Nevertheless this propagation is not without its experimental value; for, if persistently carried on, it may contribute towards the solution of a problem which has hitherto baffled scientists and cultivators alike. One never knows what a seedling is going to develop into, and the question of the inheritance of characters in the papaw is one which needs answering very badly; for there happen to be such differences between papaw and papaw that no two trees resemble each other—which is a source of constant anxiety to the cultivator as will be presently shown.

To begin with, the seeds vary considerably in number: in some fruits there are five; in others, over five hundred. But this does not mean five or five hundred potential trees. Thus, for example, when in the West Indies a native wishes to grow a single tree he buries two or three such fruits in the ground; for he knows by experience that at most two or three plants will result. Nothing could show more clearly that very few seeds are fertile, so that a discriminate selection becomes imperative. Experiments were, accordingly, carried out and it was found that seeds taken from the central portion of the largest and finest fruits were the most likely to be fertile. Seeds selected with extreme care from strong and healthy trees, the fruit of which would weigh fifteen pounds, were then sown: only a portion of the plants took after the parent stock, the other portion reverted to the wild prototype and yielded fruits the size of a hen's egg. In another series of plantings conducted with thorough preparation of the ground and selection of seeds, together with care for the young plants, only a small proportion came to maturity, and of these only a few bore fruit: none of the plants or their fruits was as large as those of the parent stock.

But still more perplexing are the vagaries of sex relation, which make the proper adjustment of the sexes difficult and exasperating. It is generally agreed that for fertilization one male to ten female plants is the proper ratio; but Kilmer speaks of numerous instances where acres of land were planted with thousands of papaw plants in which the males were in the majority of over fifteen to one. And as it is not until the flowers appear that the two kinds of tree, male and female, are distinguishable, one can imagine the cultivator's dismay when he finds at the end of all his toil and waiting—which may be as much as twenty months—that he has a plantation of unprofitable male plants.

It is best to sow the seeds in well-drained porous soil covering them about half an inch deep. In from two to six weeks the seedlings appear, germination being hastened by heat. In about a month after germination the seedlings are large enough to be transplanted to pots in which they remain for another month before being placed in the orchard where holes four feet deep and four feet wide were dug previously. The distances between trees should be about ten feet in each direction. Seeds may also be sown at stake, allowing five or six to each hole, leaving afterwards one good seedling to each hole.

The papaw tree likes deep humous or loamy soil, and flat or gently sloping well-manured land. The following fertilizer has been successfully tried at the Hawaii Experimental Station on young plants: superphosphate, 800; sulphate of potash, 315; nitrate of soda, 250; sulphate of ammonia, 190; and black sand (volcanic ash), 445 parts. This has been applied at the rate of one pound per tree at planting time. In the Bombay Presidency, house, farm, or stable refuse, twenty cartloads per acre, has been used with success. It has also been found that two ploughings and two harrowings just before sowing the seed improve the growth.

Once established, the plant is capable of enduring a wide range of moisture variations in the soil, but it is very sensitive to water-logging. Until the blossoming stage is reached the two kinds of tree are indistinguishable, and hence twice the desired number of seedlings must be planted, and all the males, except four per acre, cut out when they are recognisable. In some localities the plant begins to grow fruit in seven months; in others, eighteen to twenty months from the seed. The fruiting is abundant and continuous. In the course of one season a wild tree has been known to yield from two to three hundred fruits varying in size from a golf ball to a cricket ball. The cultivated plants may be made to yield from twelve to sixty fruits, weighing from five to twenty pounds each.

The fruits of the papaw are borne round the stem in such a way that they interfere seriously with one another's growth. It is, therefore, advantageous to remove a certain number of them to allow the rest to develop better. The difficulty is to hit on exactly the right amount of thinning to get the greatest weight compatible with the greatest number of fruits. This can only be obtained by practice and in the meantime it is advisable to remove only such fruits as are obviously going to be badly squeezed.

It is also a good thing to cut off the top of the young tree, thus forcing it to branch. Each branch bears fruits, and the bearing capacity of the tree is multiplied. It has also been observed that the branched plants were less frequently damaged by winds, and that the fruit was easy to watch and to harvest. The system of branching is very beneficial in places where the nights are cold, since the plant is protected from frost, and the fruit is produced near the ground.

The fruits on the tree must be protected from the direct rays of the sun or they scorch and split. The dead leaves of the tree should be removed as they dry up. The fruit is to be cut from the tree when full sized, but green, and is laid on soft straw to ripen. The even ripening of the papaw is a matter of considerable practical difficulty.

As a rule the tree is played out after five years' continuous cropping. Kilmer reports that a rare specimen was observed which was eighteen years old, and was bearing one to two fruits each year.

DOMESTIC USES.

In Africa, America, and the West Indies the bark of the stem is used in the manufacture of ropes.

The hollow leaf-stalks are often used as trumpets by the natives of Guam, some of whom excel in sounding military bugle calls upon them.

The property of the papaw to render meat tender is commonly made use of by cooks, who wrap the leaves round fresh meat, or place a piece of the green fruit in the water in which the meat is being boiled, or drop a little of the fresh juice in the vessel in which the meat is being cooked. In its tropical home the papaw is put into the pot with meat, and enters into cereals, soups, stews and other dishes. Most of the half-breeds in South America and the adjacent islands are particularly given to meat diet; many of them eat it raw, sometimes in a state of partial decay; and here the papaw is brought into use, being eaten with the flesh or rubbed over it before it is eaten.

In the Gold Coast Colony the leaves are added to the water when washing clothes to remove stains. In the Philippine Islands water in which the leaves have been boiled is used to wash off blood stains. In the West Indies the green leaves or slices of the green fruit are rubbed over soiled and spotted clothes, and its power of dissolving stains has earned for the papaw the name of 'melon bleach'. Elsewhere water in which a portion of the fruit has been steeped is used in washing dyed (especially black) clothes without in any way discolouring them.

Again, women in Brazil and the West Indies use the juice of the unripe fruit as a cosmetic; they apply it for freckles and for making the skin smooth and delicate. Says Kilmer: 'The strange and beautiful races of the Antilles astonish the eyes of the traveller who sees them for the first time. It has been said that they have taken their black, brown, olive and yellow skin tints from the satiny and bright-hued rinds of the fruit which surround them. If they are to be believed, the mystery of their clear, clean complexions, and exquisite pulp-like flesh arises from the use of the papaw fruit as a cosmetic. A slice of the ripe fruit is rubbed over the skin and is said to dissolve spare flesh and remove every blemish. It is a toilet requisite in use by the young and the old, producing according to the words of a French writer "the most beautiful specimens of the human race".'

When the natives of New Caledonia run short of tobacco they smoke the leaf of the papaw as a substitute. Writing from Nukahiva in 1879, M. Jouan, *capitaine de vaisseau*, tells of the trouble he experienced to keep donkeys away from his papaw trees, such was the attraction of the leaves for those animals! On the other hand, the French sailor says that the smell of the seeds was too much for the cats which turned up their noses and beat a hasty retreat.

That asses, however, are not the only members of the equine family that have a craving for the papaw, was observed by a most reliable witness, Brother Joseph Pascual, now residing in St. Xavier's College, Bombay, and from 1922 to 1923 in charge of Gayaba, a plantation situated ten miles from Madang in pre-war German New Guinea. According to the witness, Mauritz, a small long-tailed chestnut horse, imported into New Guinea from one of the neighbouring islands, was always inclined to leave the beaten track and to make a bee line for the nearest papaw tree—papaws grow wild in those parts—and Mauritz's rider could neither doze nor daydream, else he would be brought back to the stern reality under a papaw tree with Mauritz greedily devouring the leaves. But it was not only the leaves that Mauritz ate; he also sampled the fruits which he took whole—skin, flesh and seeds. And if the fruit happened to be somewhat over-ripe it was a sight to see Mauritz gobbling up the dainty with his heart in his mouth, and with the golden coloured juice and squash dripping from the corners of his lower lip.

It would also seem that in South America the younger generation makes use of the seeds to indulge their sporting propensities. As the seeds are encased in a slimy coating advantage is taken of this by playful youngsters who spread them out on a board, and by this means form a 'slide', the counterpart of the frozen gutter so agreeable to northern urchins!

In Upper Tongking, among the Tho and Man hill tribes, the fruits are fed to pigs. Throughout the West Indian islands the fruits and the leaves are fed to old hogs or poultry in the belief that their flesh will without fail become tender.

Food.

The papaw is not everywhere held in like esteem. The natives of Guam and the Marquesas do not seem to set any store by it, they only eat it when there happens to be a scarcity of other kinds of fruit. This is all the more strange because the inhabitants of the Loyalty Islands and of the other coral islands in the Pacific relish the papaw as a welcome addition to their otherwise scanty fare.

Elsewhere the papaw is considered a wholesome and nutritious food, and consumed in large quantities at all stages of its development. In every West Indian and South American village one will find a place where the native products are bought and sold, and where the wayfarer is sure to come upon an abundant supply of papaws.

As an article of food the papaw is prepared in a score of ways and made into a variety of edible dishes and delicacies.

The green fruit is cooked in curries, and is made into plain and spiced pickles which are highly esteemed. It is also boiled or stewed, and served as a vegetable. In this form it makes a splendid addition to poultry mash; and, if mixed with lime juice and sugar, is an excellent substitute for apple sauce. Europeans in Indo-China prepare it as they would salsify or artichoke.

In Malaya the green fruit, peeled, boiled, cut into small pieces, and dressed with oil, vinegar, salt and pepper is served as a vegetable. It is said to be very palatable and very similar to squash in taste.

The half-ripe fruit lightly fried in butter is a good addition to meat *à la jardinière*, and also a good ingredient in chicken or lobster salad.

The following is a useful recipe for the preparation of papaw jam: 'Choose fruit three-quarters ripe; remove all skin and seeds, chop up the fruit into small pieces; weigh; add equal weight of sugar, also some green ginger (cut into small pieces), 2 oz. of the latter being sufficient for 6 lb. of fruit; cover up the fruit and sugar, and let the latter dissolve during the night; boil up the next morning until done.'

When not quite ripe the fruit makes a good salad if cut into slices, dressed with oil, vinegar, salt and pepper, and prepared one hour before it is served. In combination with lettuce and sliced cucumber, papaws make a wholesome and nourishing salad.

The fruit, just before ripening, is peeled and sliced, macerated in cold water, with frequent changes of water for some hours; the macerated fruit is then dropped into boiling water, boiled sharply, and served as a vegetable.

The ripe fruit is generally esteemed as a table fruit, and is then eaten uncooked. It has been described as sweet, refreshing, and agreeable; but, every one will admit that it may be sickly, sweet, and insipid. The sweetness of its resinous, pulpy juice often clings to the tongue and remains prevalent for hours. In fact the stranger has first to develop a taste before he can enjoy the flavour of the fruit, and acquire a liking for it. Some people prefer to eat the papaw with salt, with salt and pepper, with a little sugar, with fresh lemon or lime juice, with sherry and cream.

In the Gold Coast Colony the ripe fruit is sometimes cooked together with corn and palm oil. In the West Indies and South America it is combined with some acid fruit and made into tarts; and at the sugar houses slices of the papaw are often seen seething in hot syrup, and pies, shortcakes, sherbets, and pickles from the fruit are greatly relished.

Excellent preserves are made of the ripe fruit, which, for this purpose, is boiled down in sugar and candied. In Indo-China the preserves are flavoured with kirsh or marasquino.

The ripe papaw is also made into jam, marmalade, jelly; it is candied, iced, crystallized and made to rival the best products of the confectioner's shop. 'Le fruit du papayer se transforme, par la confiserie, en un fruit confit d'un goût très fin et délicat rappelant celui du marron glacé associé à celui de la noisette.'

The seeds are eaten as a delicacy. They have an agreeable taste somewhat like water cress; and a piquancy suggestive of mustard. Macerated in vinegar they are served as a condiment. The natives of the tropics quite often chew them to quench their thirst.

In Malaya the small fragrant flowers of the male plant are used in the manufacture of a syrup.

Finally, when a tree has become unproductive and is cut down, the soft, pithy heart is carefully removed and grated and served in just about the same manner as a cocoanut.

POPULAR BELIEFS.

The papaw is credited to be possessed of latent and strange powers, some of them so strange that they are here set down under the heading of popular beliefs.

In Barbados the flesh of animals is reported to be hung in the papaw tree overnight in order to soften it. The same idea prevails all over India and this practice is no doubt resorted to by domestic servants and meat and fowl are often hung in the branches of a papaw tree to make them soft and tender.

The statement has likewise passed current that the emanations from the papaw tree will dissolve and digest albumin. Another statement has it that if male animals browse under the papaw tree, they thereby become emasculated.

In Africa the odour emitted by the flowers is believed to be a cause of disease.

A popular belief prevails amongst all classes of women in Southern and Western India that if a pregnant woman partake of even a moderate quantity of the fruit or of the seed, abortion will be the probable result.

In Tongking people suffering from fever are told not to eat of the papaw fruit.

In Kelantan the milky juice of the unripe fruit, mixed with the juice of the immature capsules of the horse-radish tree and the white of a lizard's egg, is used as a poison; when taken internally this is said to be followed by great abdominal pain and the presence of blood in the urine.

The papaw has been alluded to as the mustard tree of the Scriptures.

Medicinal Uses.

A plant so universally distributed and possessed of such varied properties, naturally occupies an important place in native materia medica. Though of relatively recent introduction into India it is, nevertheless, a part of the armamentarium of Ayurveda and Yunani practitioners alike. Medicinal properties are ascribed to practically every part of the tree: the root, the leaf, the seed, the fruit, and the milky juice.

To begin with the root, it is said to be a generative tonic. In Cambodia it is considered diuretic, and it is given internally to arrest the flow of blood in abnormal uterine haemorrhage. In French Guinea it is credited with anthelmintic properties, and as a vermifuge a preparation is recommended consisting of leaves and twigs of purslane 2.8 gram, fresh papaw root 0.75 gram, water 48 oz., the whole boiled down to 32 oz. In the Gold Coast Colony it is said to cure yaws and also piles: the root is ground up and mixed with salt forming a paste which is then treated with water, and the resulting solution is used as an enema; this is supposed to cause abortion in pregnant women, and its use is probably restricted to educated native women of social standing. In Mauritius the dry root has been used successfully in the treatment of kidney trouble.

As regards the leaves, they are used as a worm remedy in French Guinea. A decoction is given as a purgative to horses, and has been recommended for the treatment of bots; but Steyn in South Africa has experimentally disproved its efficacy for this purpose. In the Gold Coast Colony the dry leaves are steeped in water and the yellowish-red liquor is drunk to cure stomach trouble. In the Philippine Islands a decoction of the leaves is applied as a lotion to wounds and atonic ulcers, or the boiled leaves are crushed and made into a poultice. In the Santal Parganas of India the leaves are reputed to promote the secretion of milk: they should be gently bruised and heated in a pan and applied warm to the breast. In Western India the leaves are used externally for nervous pains; the leaf may be either dipped in hot water or warmed over a fire and applied to the painful part. In Southern India the bruised leaves applied as a poultice are said to have an excellent influence in reducing elephantoid growth. They are also used to extract guinea-worms: an ounce of the leaf is rubbed with sixty grains of opium and sixty grains of common salt, and the paste applied to the affected part—'of course the worm has to be wound out in the usual manner, but it always comes out more quickly and easily when treated in this way'.

To come to the seeds, wherever the papaw tree is found growing its seeds are used as anthelmintic and emmenagogue. In India their juice is made into pessaries to procure abortion. The juice, or a paste obtained by grinding the seeds with glycerin, is used as a cure for ringworm and psoriasis. Mixed with honey the seeds are given to expel roundworms; they are also said to be useful in dyspepsia and in enlargement of liver and spleen. In Cambodia they are prescribed in bites and stings of poisonous insects. In Central and South America they are given as a thirst quencher, and they form a component part of a drink used in fever; they are also used as a carminative.

Furthermore, the ripe fruit is alterative. It acts as a mild laxative and, if regularly eaten every morning, corrects the habitual constipation so common in India. It also acts as a mild cholagogue; hence its use for piles, and for enlarged liver and spleen; to reduce an enlarged spleen the fruit is preferably taken dry and salted. In some parts of India the ripe fruit is said to be useful in chronic diarrhoea, and in some of the Malay islands it is given in dysentery. Syrups, wines, elixirs made from ripe fruit are said to be expectorant, sedative and tonic. The green fruit is a mild laxative and diuretic; when made into a curry it is eaten by women to excite secretion of milk; it possesses ecbolic properties and is often resorted to by natives to induce criminal abortion. The mature green fruit, sliced, dried and powdered, is given in doses of from 5 to 20 grains for dyspepsia. In the Philippine Islands, more especially in the province of Bulakan and in Pampanga, a decoction of the green fruit is a popular remedy for indigestion. In the West Indies a slice of the green papaw is rubbed over the pimples which accompany the first stages of the yaws, to abort them; and it is claimed that the ulcers which follow the pimples may also be cleaned in a similar manner. In one instance apparent clinical benefit from eating the fruit was claimed by a diabetic patient; but Bischoff, Long and Sahyum failed to discover any hypoglycaemic action when feeding the fruit to rabbits.

Finally the milky juice or latex has among others a well known medicinal property, for the discovery of which the world is in the first instance indebted to an old negro woman. Cossigny relates that on her master's farm this woman was entrusted with the humble task of feeding the pigs. Now it happened that she was suffering from worms and had tried many a remedy, but thus far without any success. In course of time she noticed that whenever she fed her charges with slices of green papaw, the animals passed worms. Putting two and two together she started eating sliced green papaw and was relieved of her trouble. On hearing of this unexpected cure the men of science attributed it to the milky juice or latex contained in the green papaw; and a series of experiments afterwards proved that their surmise was correct.

The milky juice of the unripe fruit has ever since been considered anthelmintic and used as such, especially against roundworms. The following mode of administration is still adopted in Mauritius: 'Take of the fresh papaw milk and honey, of each a tablespoonful; mix thoroughly; gradually add three or four tablespoonfuls of boiling water, and when sufficiently cool take the whole at a draught, following its administration two hours subsequently by a dose of castor oil to which a portion of lime-juice or vinegar may be added. This may be repeated two days successively, if required. The above is a dose for an adult, half the quantity may be given to children between seven and ten years of age, and a third, or a teaspoonful, to children under three years. If it cause griping, as it occasionally does, enemas containing sugar have been found effectual in relieving it.' In Brazil the juice is given in very small doses to avoid intestinal inflammation.

The medicinal uses of the latex are not however limited to the removal of worms. The author of the *Makhzhan* mentions it as a remedy for haemoptysis, bleeding piles, and ulcers of the urinary passage; it is also useful in dyspepsia; rubbing the milk in, two or three times, cures ringworm or psoriasis causing a copious exudation attended with itching. The juice is often used externally to prevent suppuration. Kilmer writes: 'A malady which the natives call the "cocoa bag" is a troublesome tropical disease, reputed to be hereditary and contagious; at all events it seems to lurk in the blood of persons of otherwise apparently good health and habits. Suddenly the victim becomes a mass of offensive sores, debilitated, etc. The native doctors add the papaw fruit to the diet drinks used in this disease, and succeed in moderating its violence at least. To the sores a paste made with the papaw milk as one of the constituents is also applied.' Again: 'I witnessed a most striking cleansing of a black foot in which the chiga had bored and laid its eggs, producing a mass of foulness beyond description. Here a paste of the papaw milk was pushed into the seething mass and kept for forty-eight hours. It was then flushed, curetted, and antiseptics were applied. A clean wound which readily healed resulted.' The juice will remove pimples and thickened skin as in eczema and corns. It has been used successfully for stomach trouble; it is a reliable stomachic, and is slightly laxative; but it should not be given to pregnant women, as it is emmenagogue. It is applied locally to the *os uteri* to procure abortion. It is also said to be a certain remedy in cases of scorpion sting, a statement which has been experimentally disproved by Caius and Mhaskar. The milk has been employed in splenic and hepatic enlargements with good results; a teaspoonful with an equal quantity of sugar divided into three doses was administered daily.

The latex is slightly caustic and irritating to the skin, so much so that the collectors get blistered fingers. It has great digesting properties; if dropped on raw meat it dissolves it in a few minutes, and it is, no doubt, to this property that it owes its reputation as a digestive. It has long been used for whooping-cough in Honolulu. It has also been given with good results in diphtheria. A solution of 10 to 30 drops, applied as a paint, rapidly dissolved the false membrane. A number of cases in a hospital for children were cured by this treatment.

The milky juice is extracted by making shallow incisions with a bone or ivory knife, or a wooden splinter, in the rind of the mature but unripe fruit; the juice rapidly exudes from the cuts and is collected in a cup held beneath, then spread on glass to dry in the sun or, if the weather be wet, over a stove or in a hot-air chamber. Drying should be effected without delay but should not be too rapid, a temperature of about 100°F. being the best. The process should be completed in about 24 hours. When the material is crisp-dry, it is reduced to a fine powder, or made into a granular form, and marketed as 'papain'. About 5 to 8 oz. dried papain may be obtained per tree in a year, or an average of about 150 lbs. per acre. The fruits may be tapped at intervals of two or three days, and are not removed from the tree until they cease to yield. Good quality papain may fetch from 7 to 15*s*. per lb.; but the demand is limited and irregular.

PAPAIN.

The term 'papain' is unfortunately applied both to the dried juice of the papaw and to an albuminous digestive ferment obtained from this by precipitation with alcohol. In commerce there are a number of preparations claiming to be the ferment of the papaw, sold as *papain*, *papayotin*, *papoid*, *caroid*, *vegetable pepsin*, etc. On examination several of these substances were found to be merely the dried and powdered latex of the papaw, bearing the same relation to the true separated ferment as the dried mucous membrane of the stomach might bear to purified pepsin. As confusion reigns supreme in the literature referring to this subject, and as, except for a possible question of degree, the properties and uses of the latex and the ferment are the same, no attempt has been made here to treat the two separately.

As it occurs in commerce, papain is a greyish, fine powder, which in appearance, odour, and taste strongly suggests pepsin. Its natural colour is light brown; but bleaching is commonly practised by manufacturers. In fact much sophistication obtains in the preparation of papain. The French product is usually mixed with starch which is added as a preservative. As starch, however, is not naturally present in the fruit, it rightly figures in the list of adulterants which also includes bread, arrowroot, the milk of the wild cactus, the milk of gutta percha, boiled rice, etc. Adulteration with boiled rice, to the extent of 10 per cent, is a clever Indian adulteration difficult to detect.

Papain, which acts as a digestant in acid, alkaline, and neutral media, is used to prepare foods for assimilation, and figures largely and prominently in foods for invalids and children, in chewing gums, etc. It is extensively used as a digestive in France and Germany, and has been given with good results to children. Nevertheless, the digestive power of the papaw falls greatly short of the claims made for it. It is commonly asserted that, when the stomach is acid, it is much superior to pancreatin, because its action is not markedly affected by contact with the acid; but in experiments made by Wood with a papoid from one of the most renowned manufacturers no digestion occurred, and it is probable that most of the article of commerce is inert. As a matter of fact many practitioners prefer to papain the milky juice fresh from the tree, which is not only more efficacious as a digestive, but is in addition a good taeniacide. It has been, moreover, shown that the bleaching of papain is a great mistake and that in a representative preparation the ferment action is most marked when all the proteins are associated together in the natural form.

'Acid glycerole of papain' is largely used in dyspepsia as it dissolves mucus in the stomach, which prevents the absorption of food in cases of indigestion, colic, flatulence, gastric ulcers; and it is also greatly recommended as an aid to the nutrition of patients suffering from phthisis. The liquid preparations are said to be suitable to reduce enlarged tonsils and adenoids, but unless there is some contra-indication to thorough surgical procedure, the practice is not particularly good. For this purpose a solution of 1 to 2 of papain in 10 each of glycerin and water is swabbed over the parts. A solution of this strength is used as an application to fissures and ulcers of the tongue; though lozenges are usually preferred for syphilitic ulcers of the tongue and throat. A stronger solution, 1 part of papain in 2 parts each of glycerin and water, is sprayed into the throat to dissolve false membrane, and is applied in compresses to warts to effect their dispersion and to malignant ulcers to cleanse them. It has even been used as a local application in epithelioma; but papain as a curative agent in cancerous affections has been unanimously found wanting. A 5 per cent solution with 2½ per cent of sodium carbonate is used as drops into the ear in chronic otorrhoea. For thread-worms papain, 5 or 10 grains in a half pint of water, may be thrown into the colon as high as possible. A pigment well rubbed is used to remove corns, warts, or any hardness of the skin, and in chronic eczema.

The proteolytic power of papain is exerted on living as well as on dead proteins, and injections into the tissues bring about topical destruction. Intravenously administered it destroys the blood cells and acts as a powerful poison. Injections into tumours have been made in the vain hope of destroying their vitality, but it has been used with more or less success for the removal of false membrane from the pharynx. Hypodermic injections in cases of elephantoid growth usually results in fever and intense local irritation pointing to the unadvisability of adopting such a mode of treatment.

For internal use papain may be encapsulated or dissolved or emulsified with glycerin and aromatics, a solution of this kind making an admirable vehicle for salicylates, mercurials, iodides, iron salts, and other medicaments that might irritate the stomach. It may likewise be associated with diastase or pancreatin and given about two hours after meals, or sooner if distress be felt. Like all the digestive ferments, it must be withdrawn after a short course, except in cases in which there exists some organic lesion from which recovery cannot be expected, and artificial digestion has become a constant necessity. It has no antiseptic power and even strong solutions will putrefy.

Pa-pay-ans.

In the words of Kilmer, 'the papaw has been brought to America as a cure for the national disease, dyspepsia'. Indigestion, to call it by its name, is one of the most unpleasant joy-killers to which the normally healthy man is subject. Unless it becomes too obnoxious, it is usually endured as an annoyance, and treated as a natural consequence of the daily routine. The sufferer means to reform his habits some day. His intentions are determined while an attack is on; but when the discomfort passes and temptation again beckons, forgetting all his good resolutions he fills himself with what Shakespeare calls 'the perilous stuff that weighs about the heart'. Hence the shelves of the chemists are replete with brands of pills, lozenges, tablets, powders, wines, and elixirs without end for 'removing flatulence, vertigo, weakness, and other symptoms of indigestion quickly and pleasantly' . . . and for 'promoting appetite, digestion, and the elimination of toxic and waste material'.

One such a drug is 'Pa-pay-ans (Bell)', the selling point of which was the supposed presence of papain. This ferment, Bell and Company alleged, was present in their tablets and they claimed it to be 'the digestive principle obtained by our own exclusive process from the fruit of *Carica papaya*'. As long ago as 1909, the Council on Pharmacy and Chemistry endeavoured to detect the presence of papain and to determine the digestive power of the tablets, but with negative results. The efforts of other chemists proved equally futile. Pa-pay-ans was essentially: charcoal, baking soda, ginger, and oil of wintergreen. And, consequently, the drug possessed the virtues—and they are few—and the limitations—and these are many—inherent to a mixture of baking soda, ginger, and charcoal.

In January 1914, Bell and Company changed the name of the product 'Pa-pay-ans (Bell)' to 'Bell-ans'. As the *Journal of the American Medical Association* remarked soon after, it seemed probable that, as the name of a nostrum of this kind is the manufacturer's most valuable asset, the name was hardly changed, as was alleged, for purely euphonious reasons. It seemed more likely that as analyses had indicated there was not, and probably never had been, any appreciable amount of papain in the product, the change of name might be due to the fear that some day the misleading name might bring the preparation in conflict with the Federal Food and Drugs Act.

CHEMICAL COMPOSITION.

Upon standing for a few minutes the juice separates into two parts, an aqueous liquid and a white somewhat coagulated pulpy mass. In the aqueous portion is an albuminous substance possessed of enzymic properties, papain. According to the researches of Martin—and others—papaw juice contains besides papain, a water-soluble lipase, a lab or milk-curdling ferment, globulin, albumin, and two phytalbumoses. No peptones occur in the juice, but leucin and tyrosin are present.

The seeds contain a glucoside, caricin, which resembles sinigrin. They also contain the ferment myrosin, and by the reaction of the two a volatile pungent body is produced, smelling like oil of mustard.

The leaves have been reported to contain a glucoside, carposide.

The fruit contains vitamin C in abundance, with less of vitamin A, and still less of B.

An alkaloid, carpane, was obtained by Greshoff from the fruit and seeds, but especially from the leaves, of the papaw tree, and was afterwards studied by Merck, van Rijn, and Barger. According to Plugge, the alkaloid depresses the action of the heart and adversely affects respiration; whilst von Oefele recommends its application by subcutaneous injections as a substitute for digitalis in cardiac diseases. Chopra records that 'from the data already in hand, it is evident that it is not very toxic. A dose of 5 mgm., when injected intravenously in experimental animals, causes only a slight fall of blood pressure which, however, returns to the normal level within a very short time. The action of the heart is depressed and both the ventricles and auricles show evidence of slight depression. The respiration is not depressed to any great extent. The volumes of the different organs are very slightly affected, if at all. The alkaloid has not been used in therapeutics.'

Merck list carpaine hydrochloride as a cardiac tonic, and diuretic; for use in mitral insufficiency and aortic stenosis.

COMMERCIAL POSSIBILITIES.

By way of conclusion a few words may be said about the commercial and tradal prospects of either the papaw or papain. As far as the fruit is concerned its marketability depends evidently on three factors: transportation, demand, and supply.

The transportation question should not offer any difficulty as long as sufficiently large quantities can be procured for exportation from the plantation to the consumers. The art of transporting all kinds of fruit has reached such a degree of perfection, that there is no reason why the papaw should prove an exception to the rule as far as its preservation on board ship is concerned. In fact, successful experiments have already been made in this line between Honolulu and San Francisco.

A far more doubtful factor is the creation of a market for the papaw from a consumer's point of view. The papaw is in no way superior, and perhaps not even equal, to the home-grown fruits of those continents where it would have to be marketed. In America, Australia, and Europe apples, pears, peaches, plums, cherries, apricots, and so on are more tasty than the papaw; and this would really be a case in which a liking for the fruit would have to be gradually developed among would-be consumers. Such an experiment is likely to prove expensive; its success may be slow in coming, if it comes off at all.

Besides this, suppose a demand for the papaw should eventually materialise, there is no guarantee that the grower could be able to provide the needed supply. This brings us to consider the question whether by any means the growers can increase their harvest of papaws according to the need of the market. From what has been said when describing the fruit-bearing capacities of the tree it follows that the grower is for ever facing the unknown. It seems to be all a question of luck whether the growing plant will prove useless or fruit bearing; and, as long as these circumstances prevail, the very idea of creating a market for the papaw is somewhat in the nature of a wild goose chase.

Finally as regards the commercial prospects of papain; the latter article being a medicinal drug with well defined therapeutic properties, it stands to reason that the market for papain will mainly be determined by the needs of manufacturers of pharmaceutical products. As was already pointed out, the demand for papain has, in fact, been both limited and irregular; and there is no likelihood of its ever becoming a widespread constantly used commercial commodity.

The United States of America, the largest consumer, import annually to the value of from £15,000 to £16,000. Ceylon is one of the principal exporters: from 1911 to 1913 the exports amounted to 6,111; 12,920, and 18,548 lbs. representing a value of 34,221; 50,668, and 71,849 rupees—numbers which in respect to quantity and value bear no comparison with other commercial commodities.

There is, therefore, very little hope of a prospective boom either in papaws or in papain.

VERNACULAR NAMES.

Adang: Adiba—; *Annam*: Du du, Phan qua thu, Trai du du—; *Arabic*: Aanabahe-hindi, Amba hindi—; *Ashanti*: Bororfere, Brorfenini, Brosownini—; *Awuna*: Adiba, Aduba, Yevudiba—; *Bengal*: Papeya, Pappaiya, Pepiya—; *Betsimisaraka*: Papay, Voapaza—; *Bombay*: Papai—; *Brazil*: Mamamoeiro, Mamao, Mameo, Mamerio, Mamoeiro, Papai—; *Burma*: Pimbosi, Simbosi, Thimbaw, Timbosi—; *Cambodia*: Lohông si phle, To hong phle—; *Canarese*: Goppe, Pangi, Pappayi, Parangi—; *Carib*: Ababai—; *Cochin-China*: Du du, Kay du du—; *Cutch*: Papaya—; *Deccan*: Popai—; *Egypt*: Babas—; *English*: Melon Tree, Papaw, Papaya, Papeta, Pawpaw, Tree-melon—; *Ewe*: Adiba—; *Fanti*: Borosow, Borosownyin—; *French*: Figuier des îles, Figuier des nègres, Melon des tropiques, Papayer, Papou—; *Fulah*: Budibaga—; *Ga*: Akpakpa—; *Gujerat*: Chibda, Erandakakdi, Jhadchibhadi, Kath, Papayi, Papia—; *Hausa*: Gwanda, Gwanda masar—; *Hindi*: Andakharbuja, Papaya, Pepiya, Popaiya, Urunkhurbooza—; *Konkan*: Popai—; *Krobo*: Gor—; *Kwang Tung*: Mou Koua—; *Laos*: Mak hung—; *Madagascar*: Mapaza, Paza—; *Malaya*: Papaya, Pohunbetek—; *Malayalam*: Kappalam, Karmmosu, Pappayam—; *Marathi*: Papaya—; *Maya*: Put—; *Mexico*: Chakarateca, Jacarata, Lechoso, Melon zapote, Papaya, Papaya los pajaros, Papayo—; *Mundari*: Ambritdaru, Amritdaru, Dindapabita, Jomejaradaru, Pabitadaru—; *Paraguay*: Mamon—; *Persian*: Aanabahe-hindi, Ambahindi—; *Philippines*: Capayo, Kapayo, Papaya—; *Portuguese*: Papaia—; *Punjab*: Arandkharbuza, Kharbuza—; *Samoa*: Esi, Esi fafine, Esitane—; *Sanskrit*: Chirbhita, Erandachirbhita, Malikadala—; *Sinhalese*: Copal, Cucaracho—; *Sind*: Chilbhado, Katha, Katha chibhadu, Paputa—; *Sinhalese*: Papaw, Pepol—; *Spanish*: Papaya—; *Tagalog*: Capayas—; *Tamil*: Pappali, Pappayi, Parangiyamanakku, Pasalai—; *Telugu*: Boppayi, Madananaba, Madhurnakamu—; *Tongking*: Du du—; *Tulu*: Bappangayi—; *Twi*: Brorfre—; *Urdu*: Erand-kharbujah—; *Uriya*: Omrytobhonda, Popoya—; *Visayan*: Capayas—; *Yemen*: Amba hindi—; *Yucatan*: Chich put, Put—.

THE ORNITHOLOGY OF TRAVANCORE AND COCHIN.

BY

SÁLIM ALI.

With Notes by HUGH WHISTLER.

PART II.

(*With two plates*).

(*Continued from page* 843 *of volume* xxxvii).

SYSTEMATIC LIST.

FAMILY: CORVIDAE.

Corvus macrorhynchos culminatus Sykes. The Southern Jungle Crow.

Not collected by the Survey, but 9 specimens were kindly procured from the Trivandrum neighbourhood by the Superintendent of the Museum in connection with the revision of this form in the Eastern Ghats Survey. Mr. Whistler measures these as follows:

	Bill.	Wing.	Tail.
5 ♂♂	54.5-59	273-294	157-169.5 mm.
4 ♀♀	52-62	264-270	152-169 mm.

(The above measurements include adults and first year birds.)

Noted at: Santhanpāra (3,500 ft.—only once !), Thattākād (200 ft.), Neriāmangalam, Kotāmangalam, Kottāyam (ca. S.L.), Peermade (3,200 ft.), Kūmili (3,000 ft.), Periyār Lake Environs, Camp Derāmalāi (3,000 ft.), Rājampāra (1,350 ft.), Tenmalāi (500 ft.), Trivandrum (ca. S.L.), Cape Comorin (ca. S.L.), Arāmboli (250 ft.), Chālakūdi, Wadakkāncheri (400 ft.), Nemmāra (300 ft.), Trichūr, Karūpadanna (ca. S.L.), Ernakulam, Cochin Town.

The species was absent at Mūnnār (5,000 ft.), Balamore Estate (2,000 ft.), Kūriārkūtti (1,600 ft.) and Pādagiri (3,000 ft.). The last agrees with Kinloch's statement that it does not occur in the Nelliampathies at all. It was exceedingly rare at Marāiyūr (3,500 ft.), Santhanpāra (3,500 ft.), Peermade (3,200 ft.), Kūmili (3,000 ft.), Camp Derāmalāi (3,000 ft.) and Rājampara (1,350 ft.), only one or two examples being noted at each of these camps. It appears to avoid the hilly tracts and prefers the low country where it frequents the neighbourhood of towns and villages and is abundant, often to the point of being an unmitigated nuisance as any one who has had the pleasure of staying in the Trivandrum Dak Bungalow can testify. According to Ferguson (*J.B.N.H.S.*, xv, 255) the Jungle Crow does not frequent the hills in South Travancore, but is common at Peermade. During my camp at this place between 20 and 26 February I only saw a single example which also appeared as if it had urgent business elsewhere ! It arrived from nowhere, perched on a tree-top for a few minutes and then disappeared.

In the Pālni Hills, Fairbank (*S.F.*, v, 407) does not appear to have seen it above Vilpati village, ca. 5,500 ft.

The race *culminatus* occurs throughout Ceylon, and birds from that island and from the Travancore-Cochin area appear identical in all respects.

Breeding: On 4 March (Periyār Lake Environs) an individual was observed carrying a twig in its bill, and another on 30 March was similarly occupied.

Ferguson gives the nesting season 'in the hills and also in the low country' as April to June. 'Bourdillon and others took eggs from 27 February to 20 May in Travancore' (*Nidification*, i, p. 9).

In Ceylon Legge gives the breeding season as 'May, June and July, most nests being built in May' (*Birds of Ceylon*, p. 348). Wait on the other hand says the breeding season is 'from June till August' (2nd ed., p. 12).

Corvus splendens protegatus Madarász. The Ceylon House-Crow.

Specimens collected: 506 ♀ 2-4-33 Trivandrum (S.L.); 567 ♂ 11-4-33 Cape Comorin (S.L.); 737 ♂ 28-7-33 (Mārūthānkūzhi 50 ft.) Trivandrum Environs.

Elsewhere noted at: Thattākād (200 ft.), Neriāmangalam, Kotāmangalam, Kottāyam (S.L.), Wadakkāncheri (400 ft.), Nemmāra (300 ft.), Trichūr, Karūpadanna (S.L.), Ernakulam, Cochin Town.

Absent at: Marāiyūr (3,500 ft.), Mūnnār (5,000 ft.), Peermade (3,200 ft.), Kūmili (3,000 ft.), Camp Derāmalāi (3,000 ft.), Balamore Estate (2,000 ft.), Kūriārkūtti (1,600 ft.), Pādagiri (3,000 ft.). According to Kinloch (*J.B.N.H.S.*, xxvii, 939) it does not occur in the Nelliampathies at all.

Colours of bare parts: Iris brown; mouth brownish-slate; bill, legs, feet and claws black. Gape in juvenile pink.

[The series obtained by the Survey consists of one adult ♂ and two immature birds, and unfortunately I have been unable to supplement these with other Travancore specimens. There are none in the British Museum which has a very poor series of this common bird. The specimens measure:

	Bill.	Wing.	Tail.
567 ♂ ad.	55.5	284	169 mm.
737 ♂ imm.	53	253	146.5 mm.
506 ♀ imm.	46.5	259.5	156 mm.

The available series of *C. s. protegatus* in the B.M. consists merely of one pair of adults and one pair of immature birds. These measure:

	Bill.	Wing.	Tail.
♂ ad.	50.5	268	163 mm.
♂ imm.	49	235	131 mm.
♀ ad.	46.5	251	152.5 mm.
♀ imm.	45	220	130 mm.

In a variable species like the Crow—and the adult ♂ is much larger than the average of the House-Crows which I have measured—this series is not sufficient to settle whether Travancore and Ceylon birds are the same in size, though it suggests that the Ceylon bird is really smaller. In colour both series agree, and if the Travancore specimens are compared with specimens from the centre of the Peninsula, the difference in colour is most marked. Our Travancore specimens must therefore be considered to be *protegatus* unless and until evidence is forthcoming that Travancore birds definitely differ in size from those of Ceylon.—H. W.]

The House-Crow is a common and abundant species throughout the low country especially about towns and villages and in the neighbourhood of the homesteads and 'Kopra' depots along the backwaters. I found it most abundant in Trivandrum town, where its numbers are about equal to those of the Jungle-Crow. At Arāmboli it was noted as less numerous than the latter.

It is absent in the hills as will be seen from the above list of localities. In the Pālni Hills also, Fairbank (*S.F.*, v, 407) found it only at the base.

Breeding: As early as 31 January (Karūpadanna) a bird was observed feeding two full-fledged young with pink gapes, evidently lately out of the nest. On 15 February (Kottāyam) a nest containing 3 eggs was located at the base of the leaves of a small coconut palm, about 14 ft., standing on a bund among submerged backwater paddy-fields. Apparently brooding had not yet commenced. On 9 April (Cape Comorin) an individual was observed carrying a thorny twig into the top of a *Borassus* palm.

Specimen No. 567 (11 April) had one testis measuring 24×13 mm., the other being aborted and discoloured. It was observed that the bird had the leg on the side of the aborted testis missing from the tarsal joint.

On 14 April (Cape Comorin) a nest was noted in a *Borassus* palm at about 25 ft. in which the young could be seen moving.

House Crows (*Corvus splendens*) bathing.

Jungle Crows (*C. macrorhynchos*) at a backwater fish yard.

Photos by Author.

T. F. Bourdillon was of opinion that in Travancore although they built in May and earlier, they hardly ever laid before June. The evidence obtained by the Survey does not bear him out; Ferguson also mentions taking eggs in the Public Gardens at Trivandrum as early as February, and it seems more than likely that the majority of young, at any rate, have left the nest before the first furious onslaughts of the S.-W. Monsoon in June.

According to Legge (*Birds of Ceylon*, p. 352) the breeding season in Ceylon is from May until July. Wait (2nd ed.) gives it as 'May to August, but mainly in May and June' (p. 13).

Dendrocitta vagabunda parvula Kinnear and Whistler. The Tree-Pie.

Specimens collected: 30 ♀ 7-1-33, 87 ♂ 13-1-33 Marāiyūr 3,500 ft.; 265 ♀ 11-2-33 Thattākād 200 ft.; 291 ♀ 16-2-33 Kottāyam 100 ft.; 411 ♂, 412 ♀ 6-3-33 Kūmili 3,000 ft.; 643 ♂ 21-4-33 Arāmboli 250 ft.; 706 ♂ 22-7-33 Trivandrum 100 ft.; 760 ♂ 31-7-33 (Marūthānkūzhi 50 ft.); 836 ? 11-8-33 (Pūlayanārkotta 200 ft.) Trivandrum Environs; 906 ♀ 26-11-33 Wadakkāncheri 400 ft.; 1026 ♂ 27-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Rājampāra (1,350 ft.), Cape Comorin (ca. S.L.), Chālakūdi, Nemmāra (300 ft.), Trichūr.

Absent at: Mūnnār (5,000 ft.), Santhanpāra (3,500 ft.), Peermade (3,200 ft.), Camp Derāmalāi (3,000 ft.), Balamore Estate (2,000 ft.), Kūriārkūtti (1,600 ft.), Pādagiri (3,000 ft.).

Colours of bare parts: Iris orange- to reddish-brown; bill slaty-black, paler at gape and chin; mouth slate colour; legs and feet brownish-slate; claws horny-brown or horny-black.

[Measurements:

	Bill.	Wing.	Tail.
6 ad. ♂♂	31-33.5	137-150	209-221 mm.
5 ad. ♀♀	29-31.5	131-144	196-204 mm.

With the exception of Nos. 411 and 412, the pair from Kūmili, which are rather pale, this series supports the division of South Indian birds into a pale race on the east and a dark race on the west, and the race *parvula* must undoubtedly be recognised. It only differs from the typical race in size, and of course intergrades with it.—H. W.]

The Tree-Pie is a common species in the low country, in open deciduous forest, and as Ferguson remarks, it does not (as a rule) ascend the hills, although at Marāiyūr (3,500 ft.) it was present in small numbers. Kinloch also found it in the Nelliampathies, but very rare (*J.B.N.H.S.*, xxvii, 939-44). In the hills this species is usually replaced by *D. leucogastra* as was the case in most of the localities where I have marked it absent. In localities like Thattākād and Rājampāra, where rubber plantations were surrounded by or alternated with tropical evergreen forest, both the Pies were met with side by side.

A favourite resort is rubber plantations of which there are several near Thattākād, between Kottāyam and Mūndakāyam, and elsewhere. The birds are also partial to the gardens of cocoanut, jack-fruit, mango, plantain and cashew which usually surround the homesteads by the backwaters and are such a feature of the countryside here.

Tree-Pies are invariably present among the localised associations of mixed bird species that move about in the deciduous forest in search of food, principally insects. In the evergreens their place is filled by *Dendrocitta leucogastra*, whose constant association with *Dissemurus paradiseus* has often been commented upon, e.g. by Kinloch in the Nelliampathies (*J.B.N.H.S.*, xxix, 294). As I have already pointed out in the report of the Hyderābād Survey (*J.B.N.H.S.*, xxxvi, 370) there is nothing mysterious about this association. It is merely the result of a convergence of interests which, as a rule, involves many other but perhaps less conspicuous species as well. The largest and most prominent members of such associations in dense evergreen jungle are usually the South Indian Tree-Pie and the Racket-tailed Drongo, and these two have naturally attracted the most attention from observers.

Peepal figs (*Ficus religiosa*), when available, form an important item in the dietary of these birds, and they unfailingly resort to the trees to feed in mixed avian company. At Marāiyūr they were noted as partial to plantain (*Musa*) gardens, singly or in pairs, tearing off and feeding on the inflorescence and doing considerable damage.

Fairbank (*S.F.*, v, 407) obtained it at 5,000 ft. in the Pālni Hills.

Breeding: Specimen No. 291 (16 February) had a clearly granulated ovary with the follicles measuring 1 mm. in diameter.

Nos. 411 and 412 (6 March), a pair, were both carrying twigs for a nest in leafless deciduous jungle, and were obviously ready to breed. The testes of the male measured 9×5 mm. (slaty pigmented) while the largest ovarian follicle of the female was about 2.5 mm.

On 18 April (Arāmboli), H. took a clutch of 4 fresh eggs from a nest in a Neem tree at about 25 ft., in the Camp Shed compound. The nest was a flimsy structure of Babool and other twigs surrounding a shallow cup of finer twigs and rootlets through which the contents were visible from below. The eggs were very pale reddish-white in ground colour, sparsely speckled with light brown, and measured 27×21 (2), 26×21 and 26.5×21 mm.

The male of this pair, which had the central tail feathers missing (No. 643) was shot on 21 April. Its testes measured 9×5 mm. By 28 April, when the place was re-visited, the female had apparently provided herself with another mate and laid again (?), as one of the birds was observed to leave the nest on which it had been sitting!

On 21 April—by which date only pairs were in evidence and everywhere chivvying and chasing off Jungle Crows etc. from the neighbourhood of their territories—another nest was found in a *Thespesia populnea* tree, at about 12 ft., growing on a bund in a coconut plantation. It was similar in structure to the first and contained 5 eggs, also of the same type.

None of the other specimens showed any genital development.

From the evidence it appears that it is perhaps an earlier breeder on the whole than suggested by Ferguson's 'It breeds during the S.-W. Monsoon', i.e. between the middle of May and the middle of September, though some birds may of course do so during that period. It is significant also that none of the 3 specimens collected in the environs of Trivandrum in July and August show any departure in their gonads from the normal non-breeding condition, while two of the birds are even undergoing complete post-nuptial moult. The third (11 August) is immature in post-juvenal body moult. 'Bourdillon and Stewart found it breeding almost entirely in March and April, though a few birds continued to lay until the end of June' (*Nidification*, i, 33).

Dendrocitta leucogastra Gould. The Southern Tree-Pie.

Specimens collected: 200 ♀ 3-2-33, 266 ♂ 11-2-33 Thattākād 200 ft.; 456 ♂ 17-3-33 Rājampāra 1,350 ft.; 672 ♂ 26-4-33 Balamore Estate (2,000 ft.).

Elsewhere noted at: Santhanpāra (at 4,500 ft.), Kūmili (3,000 ft.), Camp Derāmalāi (3,000 ft.), Kūriārkūtti (1,600 ft), Pādagiri (3,000 ft.).

Colours of bare parts: Iris dark crimson; bill horny-black; mouth dark slate; legs, feet and claws blackish-brown.

[Other specimens examined:

Sparrow Coll.: ♀ 20-3-14 Cardamom Hills. Wings albinistic.

Brit. Mus. Coll.: ♀ 7-12-78, ♂♀ 18-10-78, ♂ no date, ♂ 27-11-74 Mynall, Travancore (Bourdillon); ♂ no date, Travancore (Bourdillon).

Bom. Nat. Hist. Soc. Coll.: ♂♀ 14-8-93 Thekadi, Travancore (J. P. Cook), ♂ 30-12-94 Ponnalore, Travancore (F. J. Inglish), ♂ -12-90 Ponmudi.—H. W.]

The Southern Tree-Pie is essentially a bird of evergreen rain forest and sholas, and completely replaces *D. vagabunda* in such biotope. In localities like Thattākād and Rājampāra, however, where there is a mixture of the two types of forest, with either preponderating in adjacent areas, both the species may occur side by side. Cardamom sholas are a favourite haunt; the birds—pairs or small parties—are very regular components of the localised bird associations in forest, of which *Dissemurus paradiseus* is another constant member, and *Tchitrea*, *Hypothymis*, *Culicicapa*, *Phylloscopus occipitalis*, *Sitta frontalis* and *Machlolophus* some of the usual but less obtrusive partners.

The call-notes of this species are loud and more metallic than those of *D. vagabunda*, and often closely resemble those of its habitual companion the Racket-tailed Drongo. The bird has a habit of raising its tail and depressing the forepart till the body assumes a horizontal stance, and then of ludicrously bobbing or 'jumping' up and down on its perch as it utters a throaty 'chough-chough-chough' like some Japanese clockwork toy!

This Tree-Pie does not occur in Ceylon.

Breeding: In specimen No. 200 (3 February) the ovary appeared to be maturing, some of the largest follicles being about 2 mm. in diameter. No. 266 (11 February) had testes measuring 9×6 mm. and it was in freshly moulted immaculate plumage. No. 456 (17 March) from its narrow central tail feathers was apparently a first year bird with testes in normal non-breeding condition. No. 672 (26 April) had its testes enlarged to breeding size—8×6 mm.—and it had a prominent incubation patch.

Bourdillon states that its eggs may be obtained in March and the beginning of April at elevations of 2,000-3,000 ft. above sea-level. My notes tend to confirm this statement in the main, though perhaps February to April would be more correct. In suitable localities (cf. Thattākād, Rājampāra) however, it doubtless breeds at considerably lower elevations.

According to J. Stewart (quoted by Baker, *Fauna*, i, 52) it breeds in Travancore again in August, but of this I have no confirmation.

On p. 38, vol. i, *Nidification of Indian Birds*, Stuart Baker remarks on the similarity of the eggs of this Tree-Pie to those of the *formosae* and not the *vagabunda* group. Its closer relationship with the former is also confirmed by the immature plumage. First winter birds, which of course retain juvenile wings and tail, can only be distinguished from adults by the narrower, less spatulate tail feathers as in *formosae*, lacking the pale rufous tips of *vagabunda*. Mr. Whistler describes the juvenile plumage from a specimen in the British Museum as being exactly similar to the adult, save for the shape of the tail feathers and a slight brown fringing to the tips of the lesser wing coverts and rump.

FAMILY: PARIDAE.

Parus major mahrattarum Hartert. The Southern Grey Tit.

Specimens collected: 90 ♂ 14-1-33 Marāiyūr 3,500 ft.; 380 ♀, 381 ♂ 1-3-33 Kūmili 3,000 ft.; 907 ? 26-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Rājampāra (1,350 ft.).

Absent at: Thattākād (200 ft.), Peermade (3,200 ft.).

Colours of bare parts: Iris brown; bill blackish-brown; mouth pinkish; legs and feet slaty-blue; claws horny brown.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
4 ♂♂ 1 ♀	11-11.5	61-66	52-55 mm.

Further specimens examined:

Brit. Mus. Coll.: ♂ 16-3-95 Motachi-mali [?], S. Travancore (Bourdillon); ♂ 21-3-95 Mynall, Travancore (Bourdillon).

This race has an unusually wide range in India and Ceylon, yet no further subspecies can be made though in the South the central tail feathers are slightly blacker than in Rajputana. Travancore and Ceylon birds are inseparable.—H. W.]

This is a bird of open and light deciduous or secondary forest and avoids evergreen jungle. Small flocks or pairs were met with, usually among the localised bird associations. Rājampāra is the only locality where it was noted as fairly common.

In the Pālni Hills, Terry (*S.F.*, x, 478) found it in the Pittur Valley.

The Grey Tit is fairly generally distributed in Ceylon.

Breeding: Specimens Nos. 380 and 381 (1 March), a pair, were evidently breeding from the condition of their organs, presence of incubation patch and worn plumage. The testes of the ♂ measured 6×4 mm., the largest ovarian follicles in the ♀ being about 1.5 mm. They were hopping about on the ground among fallen leaves etc. in open deciduous forest, collecting nest-lining material. This would make it appear that the breeding season in Travancore agrees with that in the Nilgiris—February to May.

The main breeding season in Ceylon seems to be March to July.

Machlolophus xanthogenys travancoreensis Kinnear and Whistler. The Travancore Yellow-cheeked Tit.

Specimens collected: 134 ♂ 23-1-33, 141 ♀, 142 ♂? 24-1-33, 162 ♀ imm., 163 ?, 164 ♀ imm. 26-1-33, 178 ♀ 28-1-33 Santhanpāra 3,500 ft.; 425 ♂ 9-3-33 Camp Derāmalāi 3,000 ft.; 976 ♂, 978 ♂ 13-12-33 Pādagiri 3,000 ft.

Elsewhere noted only at Mūnnār (5,000 ft.), and as absent at Thattākād (200 ft.) and Peermade (3,200 ft.).

Colours of bare parts: *Adult*: Iris brown; bill (♂) horny-black or (♀) horny-brown; mouth pink; legs and feet bluish-grey; claws duskier. *Immature*: Gape yellow; commissure and tip of lower mandible whitish; mouth yellowish-pink; rest as in adult.

[Comparison of this fine series with the Eastern Ghats and Hyderabad Survey specimens—all fresh skins in which museum fading has not had time to take place—shows that the new race *travancoreensis* is a very good one. Compared with *aplonotus* the upper parts are a duller more saturated green, and the yellow of the lower parts is duller and more washed with olive green. The other differences in the wings noted in the original description (*J.B.N.H.S.*, xxxv, 519) are not confirmed as constant, but the white tips to the tail-feathers are smaller in *travancoreensis* than in *aplonotus*.

Mr. Sálim Ali has contributed to the problems connected with the plumages of the species as given under the above reference. Nos. 134, 142, 976 and 978 are all adult males with a glossy black crest and a broad glossy black ventral band, that is to say in the plumage commonly accepted as adult plumage for both sexes. Nos. 141 and 178 are both adult females, adult in the sense that the juvenile wings and tail have been moulted and the ovaries enlarged and granular. These birds have the green crest and olive-green ventral band already described (*loc. cit.*) from six specimens in the British Museum (marked ♂, ♀, ♀, ♀, two unsexed). As similarly mature females are found with black crests and black ventral stripes and there is no evidence to suggest that this species takes more than the customary 12 months of the genus to reach plumage maturity, one can only draw the conclusion that the females of this tit are dimorphic. If the ♂ (10-12-74 Mynall, Bourdillon Collection, British Museum) is correctly so sexed, the dimorphism must extend rarely to the adult males, but I suspect an error in sexing. This bird is not itself fully adult. In these green crested birds the black shaft-streaks in the crest are variable in size, being in one specimen almost wanting.

No. 425 is a male in juvenile plumage. It is black-crested and black-banded, differing from the adult male merely in the details usual to tits, viz., the crest is shorter and a duller less glossy black; the white spots on the median and greater coverts are washed with yellow, as are also the white outer webs of the tertiaries; the black ventral band is dull and restricted in size. Nos. 162 and 164 are both females in juvenile plumage. They are black-crested but have the olive-green ventral band as in the two adult females, that is to say they agree with the three juveniles of this form already described (*loc. cit.*) from the Nilgiris. None of these specimens have started their post-juvenal moult so we have no means of knowing whether these black-crested green-banded juveniles turn into green-headed green-banded adults or what. In *M. x. aplonotus* green-banded adult females have black crests and no green-crested female has been recorded. The dimorphism in the female plumage is evidently a racial characteristic of *M. x. travancoreensis*.

Further specimens examined:

Brit. Mus. Coll.: ♂ 4-6-77 Kodaikanal (Fairbank); ♂ ♀ 12-11-78 Mynall, Travancore (Bourdillon).—H. W.]

The Yellow-cheeked Tit was fairly common in hilly afforested localities, but absent in the low country. It was usually met with in pairs or small parties and almost invariably as a member of the localised bird associations which comprised besides of *Phylloscopus occipitalis*, *Culicicapa*, *Sitta frontalis* and other species, hunting for insects among the foliage of lofty trees such as may be found in cardamom sholas.

Black-crested black-banded, black-crested green-banded and green-crested green-banded examples were frequently met in one and the same flock. Of a pair observed at Mūnnār on 16-1-33, one was black-crested black-banded, while in the other the crest and ventral band were greenish-grey. This was also the case with another pair at Santhanpāra (21-1-33) but in this case I am not sure whether the green-banded individual had a green or a black crest. At all events I never saw a pair or flock in which both or all the individuals were green-crested which precludes the suggestion of the green-headed birds belonging to a separate species and supports Mr. Whistler's conclusion that the females of this tit are dimorphic.

According to Kinloch (*J.B.H.N.S.*, xxvii, 939-944) the Yellow-cheeked Tit is extremely common in the Nelliampathy Hills. Bourdillon and Ferguson both record it to be a high elevation bird in Travancore, abundant from 3,000 ft. upwards. It is not found in Ceylon.

In the Pālni Hills Fairbank (*S.F.*, v, 407) found it sparingly at Kodaikanal and Terry (*S.F.*, x, 478) in small parties at Pulungi and Kukal.

Breeding: No. 976 (13 December) had testes measuring 7×5 mm. and had obviously just finished breeding as it was in post-nuptial moult (body and rectrices). It was accompanied by a green-banded green-crested (?) individual. No. 978 (14 December)—testes 6×4 mm.—was also undergoing post-nuptial moult, as also was No. 134 (practically completed 23 January) with testes 6×4 mm. Nos. 162 and 164 (26 January) were young birds with imperfectly ossified skulls, in juvenile plumage with the post-juvenal moult not yet started. They were of a family party of which No. 163 (in worn plumage, moult only just starting on breast) was presumably one of the parents. The latter was badly shot and could not be sexed. No. 178 (28 January)—green-crested green-banded—had a distinctly granular ovary and was undergoing complete post-nuptial moult. It was accompanied by a black-crested black-banded individual. No. 425 was also in juvenile plumage, with the post-juvenal moult not yet started.

There seems to be no recorded evidence of any nest having been taken in Travancore. Kinloch who found several nests in the Nelliampathies fails to give the dates. From the evidence obtained by the Survey, I would extend the breeding season in Travancore as suggested in the Eastern Ghats Report viz. 'July to August and possibly even later'—to the end of October or the middle of November.

FAMILY: SITTIDAE.

Sitta frontalis frontalis Swainson. The Velvet-fronted Nuthatch.

Specimens collected: 182 ♀, 183 ♂ 29-1-33 Santhanpāra at 5,000 ft.; 390 ♂, 391 ♀ 3-3-33 Kūmili 3,000 ft.; 984 ♂ 15-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Mūnnār (5,000 ft.); Thattākād (200 ft.), Ūrūmbikera Res. Forest near Mūndakāyam (ca. 1,000 ft.), Peermade (3,200 ft.), Camp Derāmalāi (3,000 ft.), Rājampāra (1,350 ft.), Balamore Estate (2,000 ft.), Kūriārkūtti (1,600 ft.).

Colours of bare parts: Iris lemon-yellow; orbital skin yellow; bill coral red, brownish at tip; palate coral, gullet pink; legs and feet brown with orange tinge; claws horny-brown.

[Other specimens examined:

Brit. Mus. Coll.: ♂ 20-1-75, ♂ ?-10-78 Mynall, Travancore (Bourdillon); ♀ 21-6-77 Pālnis (Fairbank).

Bom. Nat. Hist. Soc. Coll.: ♂ 29-1-01 Devicolam, Travancore; ♂ 3-3-94 'Pulney Ghat' (J. P. Cook).

Sparrow Coll.: ♂ 21-3-14 Cardamom Hills.

Measurements:

	Bill.	Wing.	Tail.
12 ♂♂	16-17.5	77-80.5	39.5-43.5 mm.
4 ♀♀	16-17	75.5-80	39.5-42.5 mm.

The correct type locality of this species is Ceylon as was pointed out in the *Journal N. H. Society, Siam*, vol. v, pt. 3, p. 334 (1924) and this was accepted by Mr. Stuart Baker in his vol. vii, p. 25. It is unfortunate therefore that in *Nidification*, vol. i, p. 99, he has returned to the initial mistake of the *New Fauna*, vol. i, p. 132, of stating the type locality to be Java. It is not, therefore, as he says (*loc. cit.*, p. 99) a question of separating the Javan and Indian birds and using Hodgson's name *corallina* for the Indian bird, but a question of separating the Ceylon and Himalayan birds and using *frontalis* for the former and *corallina* for the latter. Our Travancore birds agree with those from Ceylon and therefore belong to the typical race.—H. W.]

This Nuthatch is essentially a bird of evergreen jungle and is found wherever this occurs in the Travancore-Cochin area, from almost the level of the low country to the highest sholas. It is usually met with in pairs running up and down the trunks or along and around the moss-covered branches of forest trees, frequently clinging back downwards and working along their undersides. They are regular members of the mixed hunting parties. I have only once observed them venture into open leafless deciduous jungle bordering an evergreen shola. This was such an unusual occurrence that the birds (Nos. 390 and 391) were mistaken for *Sitta castanea*, and promptly shot.

In the Pālni Hills both Fairbank (*S.F.*, v, 399) and Terry (*S.F.*, x, 472) found it common in the well-wooded portions and sholas.

This Nuthatch occurs throughout Ceylon, and Travancore and Ceylon birds are quite indistinguishable.

Breeding: Specimen No. 984 (15 December) had its testes enlarged to 7×4 mm. and was in fresh plumage. Of a pair, Nos. 182 and 183 (29 January), the ovary of the female was undeveloped while the testes of the male measured 3×2 mm. and appeared to be maturing. They were both completing a general moult. In another pair, Nos. 390 and 391 (3 March) the male's testes measured 7×4 mm.; the ovary of the female was distinctly granular, the follicles measuring about 1 mm. in diameter. A prominent incubation patch confirmed the presumption that the birds were breeding.

Apparently no nests have been recorded from Travancore or Cochin, but the breeding season here appears to be from December to March or thereabouts, and therefore somewhat earlier than that given for the Madras Presidency—February to April.

According to Davison the most normal breeding months in South India are April and May. In Ceylon 'Breeding season appears to be from February to May' (Waite, 2nd ed., p. 17).

FAMILY: TIMALIIDAE.

Garrulax delesserti (Jerdon). The Wynaad Laughing Thrush.

Specimens collected: 179 ♂, 180 ♂ juv. 29-1-33 Santhanpāra at 5,000 ft.; 273 ♀, 274 ♂ imm. 12-2-33 Thattākād 200 ft.; 675 ? 27-4-33 Balamore Estate 2,000 ft.

Elsewhere noted at: Tenmalāi (500 ft.), Pādagiri (3,000 ft.).

Colours of bare parts: *Adult*: Iris scarlet ('maroon-brown' according to Kinloch); gape and upper mandible dark horny-brown, lower mandible pale yellowish flesh-colour; palate yellow, gullet pink; legs, feet and claws pinkish flesh-colour with grey tinge. *Juvenile* and *Immature*: (Nos. 180 and 274) Iris pale pinkish-buff; upper mandible horny-brown except tip, nostrils, lores and a spot on culmen near forehead, which yellow; gape and lower mandible bright yellow; eyelids bright yellow; orbital skin and aural opening paler yellow; legs and feet dusky yellow; claws paler.

In No. 675 (age ?) Iris brownish-orange; upper mandible horny-brown, lower mandible pale yellow or cream; a bare post-orbital patch bluish-slate; legs and feet dirty brownish-grey; claws creamy-white.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
3 ♂♂ ad. and imm.	30.5-31	100-108	99-102 mm.
1 ♀	31.5	108.5	101 mm.

Further specimens examined:

Brit. Mus. Coll.: ♂ 8-1-73 Assambo Hills; ♀ 30-12-94 Bonacaud, Travancore (A. N. Nair); ♀ 27-4-74 Mynall (Bourdillon).

Stuart Baker says (*New Fauna*, vol. i, p. 149 and *Nidification*, vol. i, p. 111) that this Laughing Thrush is confined to the hills of South-West India from the Wynaad to South Travancore. This distribution is manifestly incorrect as in the next paragraph he goes on to quote the discovery of the nest by John Davidson in North Kanara. It is, as a matter of fact, common almost throughout the hills of North Kanara (Davidson, *J.B.N.H.S.*, xi, 655) and South Kanara (Bell apud LaPersonne, *J.B.N.H.S.*, xxxvi, 503).

The juvenile plumage does not appear to be represented in any collection, but from specimen No. 180 which is in post-juvenal moult, it is evident that the juvenal plumage is—as one would expect—very similar to that of the adult. It, and therefore the first winter bird (No. 274), show the normal differences of young Timaliine birds, namely a soft blunt first primary and narrow pointed tail-feathers. As the breeding season is evidently late in the heaviest part of the monsoon the post-juvenal body moult is taking place about January-February. The adult post-nuptial moult therefore is probably about November-December, but no specimens have been seen.—H. W.]

This Laughing Thrush is also confined to the heavy rain-forest areas of Travancore-Cochin. The Surveys came across it from almost the level of the low country (Thattākād 200 ft.) to about 5,000 ft. in the Cardamom Hills at Santhanpāra, and it probably occurs, as Ferguson says, at all elevations. It goes about in noisy flocks of 6 to 10 birds, keeping principally to the dense cane-brakes and evergreen undergrowth, preferably on the edge of footpaths and cardamom clearings, where they rummage among the fallen leaves and mulch in search of insects, in the manner of the family. They are great skulkers when alarmed, and give vent to a variety of squeaky shrieks as they scuttle away from danger.

This Laughing Thrush is not found in Ceylon.

Breeding: Specimen No. 179 (29 January) had testes measuring 10×6 mm. (slaty pigmented). No. 180, a member of the same flock, was juvenile with very imperfectly ossified skull and in heavy post-juvenal body moult. It was probably not more than 1-1½ months old. No. 273 (12 February) had a mature ovary, the largest follicles measuring about 2 mm. in diameter, and the bird was in worn breeding plumage. It was of a flock from which also was secured No. 274, an immature ♂ with partially soft skull and in heavy general moult in which the tertiaries were also involved. No. 675 (27 April) was undergoing a body (post-nuptial ?) moult.

It would appear from the above that the breeding season in this area is somewhere between December and the first two or three months of the year. What is more probable, however, is that as in some of the other members of this family, it is rather erratic and ill-defined. Ferguson says that it breeds in June. He quotes the description of a nest found by T. F. Bourdillon (*J.B.N.H.S.*, xv, 257) but omits to give the date.

Stewart took nests and eggs in the Ventura Valley, Travancore, from 7 April to 28 August. According to him, it breeds principally during the South-West Monsoon when the rainfall is about 150 inches. Normal c/3 or c/4, but 2 nests contained 6 and 7 eggs each presumably laid by 2 hens (*Nidification*, i, 111).

T. R. Bell says (apud LaPersonne, *J.B.N.H.S.*, xxxvi, 503) that in Kanara it invariably nests in or on 'Karvi' (*Strobilanthes*) stems and nearly always in the monsoon months—July to September—in anything from 250-350 inches rainfall.

Trochalopteron jerdoni fairbanki Blanford. The Travancore Laughing Thrush.

Specimens collected: 19 ♀ 6-1-33 (4,500 ft.), 57 ♂, 58 ♀, 59 ♂ 10-1-33 (7,000 ft.) Marāiyūr; 101 ♀ 17-1-33, 106 ♂, 107 ♂, 108 ♀ imm. 18-1-33, 117 ♂ 20-1-33 Mūnnār 5,000 ft.; 145 ♂ 24-1-33 (4,500 ft.), 181 ♀ 29-1-33 (5,000 ft.) Santhanpāra.

Not met with elsewhere.

Colours of bare parts: *Adult*: Iris reddish-brown; bill horny-brown; mouth pink; legs and feet slaty-brown; claws brown; soles of feet greyish-yellow. *Immature* (No. 108): Iris brown; mouth pale yellowish-pink; rest as in adult.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
6 ♂♂	21.5-23	82.5-89.5	85.5-93 mm.
5 ♀♀	19.5-23	83-86	86-91 mm.

(The above include both adult and immature birds.)

No. 108 is still in juvenile plumage and is similar to the adult except that the crown and nape are not so dark, contrasting therefore less with the mantle. The shape of the first primary and tail-feathers is rather variable in this species, making it more difficult to distinguish by them adults and first-year birds—doubtless another manifestation of the plastic nature of this species which has produced three races in a small area.

Of the series obtained, two adults are in complete moult in January which suggests that the breeding season must extend later than 30 May as given in *Nidification*, vol. i, p. 140.

The distribution of this species was given wrongly in the *New Fauna* (vol. i, p. 178), South Travancore having been erroneously mentioned instead of the High Range of North Travancore. It is again incorrect in *Nidification* (vol. i, p. 139) where the Travancore area is totally omitted!—H. W.]

The Travancore Laughing Thrush is a bird of high elevations, never in my experience met with below 4,000 ft., and thence up to the highest limits of suitable biotope. As I have pointed out elsewhere, they appear to be inseparable from the facies in which the wild Raspberry plant (*Rubus*) grows—in Travancore also from an elevation of about 4,000 ft. up. Whenever this elevation was reached and *Rubus* appeared, I invariably found *Trochalopteron;* nowhere below. They move about in flocks of 6-10 birds, frequenting dense scrub and undergrowth, preferably bordering hill streams. When alarmed, the birds utter a low 'wit-wit-wit' and disappear through the undergrowth like *Dumetia*, rarely showing themselves. They are inveterate skulkers and can seldom be made to leave cover even when pelted at with stones. The alarm notes or squeaky shrieks are similar to those uttered by *Turdoides somervillei,* but louder and somewhat shriller.

These thrushes were extremely common at Mūnnār (5,000 ft.—Kannan Dēvan Hills) where they kept to the scrub of *Rubus* and bracken bushes lining streams and nullahs through the extensive tea plantations, and on the outskirts of the town. At Santhanpāra (above 4,000 ft.—Cardamom Hills) they were partial to the dense growth of Eeta (*Ochlandra travancorica*) and secondary jungle bordering cardamom cultivation among the higher hills. They are very fond of the berries of *Maesa perrottetiana* D.C. and *Trema orientalis* Blume which comprised a large portion of their food at this season.

The statement of Ferguson's that this race is found from the Achankovil Gap (lat. 9°5′ N.) northwards through the High Range into the Ānnemalais and Pālnis is probably correct, though I was unable to verify the exact limit of its southern distribution. Kinloch does not record it in the Nelliampathies, neither did I come across the birds in these hills during the Cochin Survey. However, I never seem to have struck the required *Rubus* facies though the hills up to about 4,500 ft. were worked fairly thoroughly. In the Ānnemalai Hills about Kūriarkūtti, both *Rubus* and *Trochalopteron* were absent to an elevation of about 3,800 ft.

Both Fairbank (*S.F.*, v, 404) and Terry (*S.F.*, x, 475) found this Laughing Thrush very common in the shōlās above 5,000 ft. in the Pālni Hills. It is said to damage peaches and raspberries at Kodāikānal.

This species is not represented in Ceylon. It must be far more sedentary than most to have attained the unusual distinction of producing three races within so small an area of South-West India, and to be represented by a distinct species in the Nilgiris.

Breeding: Specimen No. 108 (18 January) was an immature bird with very soft skull and in juvenile plumage with some feathers still ensheathed and growing. It was probably not more than 1½ months old. An adult male on the same date was in worn breeding plumage with testes measuring 5×3 mm.

Specimen No. 181 (29 January) on the other hand, was in fresh plumage with a firm and granulated ovary in which the follicles measured about 1 mm, in diameter. It was, moreover, one of a pair and presumably preparing to breed.

From the evidence, I am inclined to the opinion that the breeding season in the Travancore-Cochin area at any rate, is far from well-defined and extends over the greater part of the year except perhaps the two or three months of heaviest rainfall. Possibly, of course, some months as between March and June may be more favoured than others.

Terry gives the following records of nests found by him in the Pālnis: c/2 fresh eggs, 30 May, Kodāikānal; c/2 fresh eggs, 20 May, Kukal; c/1 very hard set, 6 June, 2 young birds about a week old on 8 June.

Trochalopteron jerdoni meridionale Blanford. Blanford's Laughing Thrush.

Specimens collected: 667 ♂ juv., 668 ♀ juv., 669 ♂ imm., 670 ♂ 25-4-33 Mūthūkūzhi 4,000 ft. (Ashambū Hills).

Elsewhere not met with.

Colours of bare parts: *Adult* (No. 670): Iris crimson; bill horny-brown; mouth pink; legs and feet brownish-slate; claws horny-brown; soles yellow. *Immature* (No. 669): Iris olive-brown; mouth pinkish-yellow; rest as in adult. *Juvenile* (Nos. 667, 668): Iris olive-brown; bill horny-brown except commissure and extreme tip, which yellow; gape and mouth bright yellow; legs, feet and claws as in adult.

[It may be useful to summarise from fresh specimens the differences between this and the last form:

T. j. fairbanki.	*T. j. meridionale.*
1. Crown and nape dark sooty brown, in some specimens almost blackish, remainder of upper plumage wings and tail olive-brown, contrasting with the crown and nape.	1. Crown, nape, upper parts, wings and tail dull sooty greyish-brown throughout with no contrast between them.
2. Supercilium long, broad, clearly defined and pure white. Below it a blackish stripe through the eye from the lores, contrasting with the grey cheeks.	2. Supercilium short, narrow, ill-defined and mostly grey. Blackish stripe below only distinct on the lores.
3. Chin, throat and breast more grey than white. Centre of abdomen rufous, a little paler than the flanks.	3. Chin, throat and breast more white than grey, the white extending down the centre of the abdomen to the vent.

Further specimens examined:

Brit. Mus. Coll.: 3 from Mynall (Bourdillon); 1 from Ponmūdi 3,500 ft. (Ferguson and Nair); 1 from Colathorpolay (Kolāttūpūzha) 3,800 ft., Patnas (Hume Collection); 7 from Chimpani (Davidson).

In *Nidification* (vol. i, p. 140) the mistake of attributing those localities to North Travancore (which would mean that the 2 races *fairbanki* and *meridionale* were found together) made in the *New Fauna* (vol. i, p. 179) is repeated inspite of its having been corrected in *J.B.N.H.S.*, xxxv, 524 !—H. W.]

This race replaces *fairbanki* in the hills of South Travancore—according to Ferguson from the extreme south to the Achankovil Gap. The exact limits of its range have not been determined by the Survey. In haunts and habits there is no difference to record from the last.

Breeding: Nos. 667 and 668 (25 April) from the same flock and apparently of the same brood, had very soft skulls (cf. also colours) and were in juvenile plumage which is evidently similar to that of the adult. I estimate that they were about a month old. No. 669 was slightly older, aged perhaps 1½-2 months, and No. 670, in spite of the size of its testes (8 × 5 mm.) was undergoing complete post-nuptial moult.

Ferguson says: '. . . as I shot a young bird in March just out of the nestling plumage, I conclude that the breeding season is about May and June'. It is difficult to follow his line of argument, but the Survey specimens suggest that in March breeding is certainly in progress. Like the foregoing, however, it may also breed over other months of the year.

Two clutches found by Mr. J. Stewart on 10 June 1906 and 4 June 1912 (at 3,000 ft. in thick evergreen forest) are recorded in *Nidification*, i, 140. There may, however, be some mistake over the identity as the eggs are described as being not like those of the foregoing form, but exactly like those of the Nilgiri Blackbird!

Turdoides somervillei malabaricus (Jerdon). The Malabar Jungle Babbler.

Specimens collected: 234 ♀ 7-2-33 Thattākād 200 ft.; 864 ♀ 14-11-33, 889 ♀ 21-11-33 Kūriārkūtti 1,600 ft.; 901 ♀ Wadakkāncheri 400 ft.; 1029 ♂ Karūpadanna ca. S.L.

Elsewhere noted at: Marāiyūr (between 3,500 ft. and 4,500), Kottāyam (ca. S.L.), Kūmili (3,000 ft.), Rājampāra (1,350 ft.), Tenmalāi (500 ft.).

Noted as absent at: Santhanpāra (3,500 ft.), Trivandrum and Cape Comorin (ca. S.L.), Aramboli (250 ft.).

Colours of bare parts: Iris creamy- or yellowish-white; bill and circumorbital skin pale yellow; gape and mouth bright deep yellow; legs, feet and claws pale yellow.

In this species the bright colour of the juvenile gape persists in the adult, and the mouth also retains to a large extent the conspicuous juvenile colouring.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
1 ♂	24	107.5	105 mm.
4 ♀♀	24-24.5	101-107	99-101.5 mm.

This species is not represented in the British Museum by any specimens from Travancore and at the time of writing my report on the birds of the Eastern Ghats Survey I had seen no specimen from that State. I had therefore no reason to differ from the commonly accepted view that only one race of this Babbler—*T. s. malabaricus*—was found in Southern India. The five specimens procured by the Travancore-Cochin Surveys clearly show that view to be wrong. When they are compared with the fine series obtained by the Eastern Ghats Survey it is seen that the upper parts are a darker richer brown, particularly noticeable on the rump, upper tail coverts and tail. The lower plumage also is darker and more richly coloured throughout, the fulvous wash on the breast and abdomen being deeper and more richly coloured. It is, therefore, necessary to establish which of these two South Indian forms should rightly bear the name of *malabaricus* and whether any other name is available for the other. Luckily there is no difficulty about the matter.

Jerdon described his *Malacocercus malabaricus* from the 'forests of Malabar, and on the sides of the Neilgherries up to the very edge of the Hills'. It is never quite clear what is meant by the 'Malabar' of the older writers, but Jerdon's use of the term in many cases, and evidently in this case too, often refers to Travancore where indeed he had been previous to the publication of this name. The matter is made clearer from his description at the same time of another new form *Malacocercus orientalis*[1]. Jerdon described it as 'found in the jungles of the Carnatic, and more especially amongst those of the Eastern Ghats, where it is very abundant, whence the name I have proposed'.

The difference of colour between *malabaricus* and *orientalis* given in the description shows that Jerdon in these two names was deliberately describing the two South Indian forms now obtained by the Surveys. He also made it clear that neither had anything to do with the *somervillei* of Sykes and Bombay.

Blyth, no doubt, later suggested to Jerdon that his two forms were based on individual differences, for in the *Birds of India*, vol. ii, p. 63, the latter says in 1863: 'In my "Illustrations" I separated those from the Eastern

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[1] This name in the *New Fauna*, vol. vii, p. 36, for some reason is placed as a synonym of *Turdoides terricolor terricolor* (rectius *T. somervillei terricolor*) but there the type-locality is omitted and the type-locality alone is sufficient to show that the attribution is wrong.

Ghauts under the name of *M. orientalis.* This race, however, has not been considered distinct from *malabaricus*, and I have accordingly merged it in that species. Malabar specimens appeared to me to have more rufous; those from the Eastern Ghauts more grey.'

Our Travancore-Cochin series, therefore, represents the true *malabaricus* of Jerdon. The better-known race of the Jungle-Babbler found throughout the greater part of the Madras Presidency, and hitherto known as *malabaricus*, must in future be known as *Turdoides somervillei orientalis* Jerdon (*Ill. Ind. Orn.*, text to pl. 19, 1845 (March), type-locality: Eastern Ghauts), and under that name, therefore, should be listed all the specimens listed as *T. s. malabaricus* 737 on p. 378 of the *J.B.N.H.S.*, vol. xxxv, Eastern Ghats Survey, and on p. 373, vol. xxxvi, Hyderābād Survey.—H. W.]

The Jungle Babbler is a common bird in the Travancore-Cochin area, though patchily distributed. Flocks frequent deciduous and bamboo forest or scrub jungle with Lantana etc., where they rummage among the fallen leaves for insects. It avoids evergreen jungle, but may sometimes be met with in the secondary growth on its outskirts. The flocks habitually form the nucleus of the localised bird associations and are seldom met independently of them. They are also partial to the neighbourhood of homesteads along the backwaters, frequenting the mango, jack-fruit and cashew gardens, often in association with *Turdoides striatus.* As I have remarked before in the Hyderābād Survey Report (*J.B.N.H.S.*, vol. xxxvi, p. 373) my experience does not bear out the statement on p. 737, vol. xxxv, that it does not mix with the White-headed Babbler. It is true that as a rule the two species inhabit different facies, but where these overlap, the birds may frequently be seen in association with each other and with other avian species.

A flock at Marāiyūr (14 January) was noted in my field-book as composed of particularly rufous tinged individuals, very reminiscent of typical *somervillei* of Bombay. The rufous colour was no doubt accentuated by some peculiarity in the lightning conditions, but its presence is now confirmed and explained by Mr. Whistler's note.

A habit with this species when curious or agitated, is to fluff out its plumage especially that of the back which assumes an arched appearance, droop the wings at the sides, spread and depress the tail and pivot uneasily from side to side, peering at and chivvying the intruder the while.

As pointed out in the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, 738) the statement in the *Fauna* (vol. i, p. 195) that *T. s. somervillei* occurs from Travancore to Bombay along the West Coast is apparently based only on wrong identification of the ferruginous stained specimens of *T. striatus polioplocamus* obtained at Kolachāl (Travancore).

In the Pālni Hills, Fairbank (*S.F.*, v, 405) found it common at the base and in thin jungle on the sides up to 4,500 ft. He procured a ♂ at Vengayam Parry on 1 June. Terry (*S.F.*, x, 475) describes it as rather rare at Pulungi, but very common lower down on the slopes and in the Pittur valley.

It does not occur in Ceylon, where according to Whistler (*J.B.N.H.S.*, xxxv, 738) *T. striatus striatus* represents both the Jungle and White-headed Babblers and is a connecting link between them.

Breeding: No. 234 (7 February) had a mature ovary with follicles measuring 1-1.5 mm. In No. 1029 (27 December) the testes were enlarged to 7×5 mm., and both these individuals were either breeding or ready to breed. The specimens obtained in November and December were not in moult. A ♀ (7 February) had slight traces of moult on head and neck.

The above specimens suggest December to February as being at least part of the breeding season in the Travancore-Cochin area. The probability, however, is that it breeds irregularly more or less throughout the year as in other parts of the range of the species.

Bourdillon and Stewart record January to March as the principal breeding months in Travancore though they also say that breeding is fitful and very irregular. In the Nelliampathy Hills (Cochin) A. P. Kinloch took most nests in bamboo clumps in mixed scrub and bamboo jungle, often at considerable elevations (*Nidification*, i, 154). No date!

In the Pālni Hills, Terry (*S.F.*, x, 475) records nests as follows: c/3, incubated, 5 April—Pulungi; c/2, incubated, 6 April—Pittur Valley.

Turdoides striatus polioplocamus Oberholser. The White-headed Babbler.

Specimens collected: 13 ♂ 5-1-33, 86 ♀ 13-1-33 Marāiyūr 3,500 ft.; 504 ♀, 505 ♀ 2-4-33 Trivandrum ca. S.L.; 533 ♀ 8-4-33 Cape Comorin ca. S.L.; 569 ? naked chick ex nest 11-4-33; 610 ♀ 17-4-33 Arāmboli 250 ft.; 683 ♀ imm. 17-7-33 (Pattom 50 ft.); 723 ♀ 25-7-33 (Thirūmalāi 120 ft.); 813 ♀ 8-8-33 (Mūkūnnimalāi 800 ft) Trivandrum Taluk; 908 ♀ 26-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Chālakūdi, Nemmāra (300 ft.), Trichūr, Karūpadanna ca. S.L.

Colours of bare parts: *Adult*: Iris from creamy- or greyish-white to pale sky blue; bill, legs, feet and claws pale sickly yellow; mouth pale pinkish-yellow. *Immature* (No. 683): 'lower mandible, legs, feet and claws greyish-white' (Pillai).

[The Survey series measure:

	Bill.	Wing.	Tail.
1 ♂	20.5	108.5	103 mm.
9 ♀♀	19-23	99-110.5	97-109 mm.

The specimens definitely belong to this form and not to the Ceylon race, which appears to be intermediate between this bird and the Jungle Babbler, connecting them.

This species has normally a complete post-nuptial moult which takes place from June to November. In practice, however, the body moult seems to be carried out in such an irregular and dilatory fashion that some feathers are being moulted all the time and practically no bird will be found with all feathers in the same state of freshness or wear. The red patches, found on some specimens, appear to have nothing to do with erythrism but to be due to the combined effects of wear and bleaching and staining.—H. W.]

The White-headed Babbler was met—with one exception, Marāiyūr—only in the low country and about the lower foot-hills in the comparatively drier localities of the States, chiefly in the precincts of villages and human habitations. It was common everywhere. In the gardens about the backwater homesteads near Karūpadanna, and in the scrub and secondary jungle surrounding the camp-shed and the terraced paddy fields at Marāiyūr, it was frequently found in association with *T. s. malabaricus*. Its food consisted to a large extent of the berries of *Lantana camara*, a species which everywhere was a conspicuous feature of its biotope.

Breeding: Specimen No. 13 (5 January) had testes measuring ca. 5×3 mm. and apparently developing. Nos. 504 and 505 (2 April) both had mature ovaries with follicles 1-1.5 mm. in diameter. No. 533 (8 April) had apparently lately finished breeding. Its ovary was as yet conspicuously granular; the plumage was worn and an incubation patch present. It was accompanied by another adult bird and a full-fledged young. On the same date Humayun observed pair feeding a ¾ grown *Clamator jacobinus*. On 11 April (Cape Comorin) he took a naked chick (No. 569) from a nest in a Babool tree (at about 5 ft.) which contained 3 others in the same stage. On 15 April a nest containing 4 eggs was found in a branch of an *Acacia planifrons* (at 12 ft.) overhanging a dry sandy nullah on the edge of a patch of Babool jungle in the Arāmboli Gap. No. 683 (17 July) was a young bird with soft skull, while No. 813 (8 August) had the largest ovarian follicle measuring about 3 mm. and was evidently breeding.

Stewart took nests in Travancore as early as February (*Nidification*, i, 156). Ferguson (*J.B.N.H.S.*, xv, 258) says that *striatus* breeds in Travancore in April and May while *griseus* (obviously referring to the same bird) does so in June. From the evidence collected by the Survey, however, the breeding season appears to be as ill-defined as in the case of some of its nearest relatives. It is possible that as elsewhere in the Madras Presidency (*J.B.N.H.S.*, xxxv, 740) the majority of eggs are laid between March and July.

Argya caudata [caudata] (Dumont). The Common Babbler.

No specimens were obtained by the Surveys, but there is one (labelled *Crateropus striatus* !) in the Trivandrum Museum with the data 'Arāmboly, Travancore, 14-6-10'. From the fact, however, that the label is not original and quite new, Mr. Whistler is of opinion that this cannot be accepted as an authentic record in the absence of any other confirmation from Travancore. He thinks that probably the specimen came from elsewhere and there was some msitake during re-labelling.

Arāmboli is the western (Travancore) extremity of a gap or pass through the barrier of hills that form the boundary between the Madras district of Tinnevelly and the Travancore State. It is in effect a miniature repetition of the Pālghāt Gap on the northern frontier of Cochin, and like it, functions as a channel of exchange for many plant forms between the two areas for some distance on either side. Through this gap also there was noted an extension into Travancore of *Lanius vittatus*, not met with elsewhere within the area, and it is readily conceivable that *A. caudata* may do so in the same way.

Fairbank (*S.F.*, v, 405) found the Common Babbler plentiful at the base of the Pālni Hills and there seems no biological reason why it should not extend southward thence through the Rāmnād into the Tinnevelly District, and thence through the pass to Arāmboli where the facies is of a character eminently suited to it.

While the Survey was working this area, I have a record in my diary that *Argya caudata* was heard. By itself this note would have been valueless and I should probably have omitted it but for the support now accorded by the Trivandrum Museum specimen. In my opinion the two records confirm each other sufficiently to be accepted until definite information to the contrary is forthcoming.

Argya malcolmi (Sykes). The Grey-headed Babbler.

Not met with by the Surveys.

In the Pālni Hills Terry (*S.F.*, x, 475) met it once 'far down the slopes towards Pulney'. The record is vague and gives no idea of the exact locality or the facies in which the birds were seen.

Breeding: 'Bourdillon obtained several nests in Travancore where, however, he says it is not common. . . In Nilgiris and Travancore, most eggs are laid in March . . .' (*Nidification*, i, 162).

I consider that the occurrence of this Babbler in the Travancore-Cochin area needs confirmation.

Argya subrufa (Jerdon). The Rufous Babbler.

Specimens collected: 139 ♂ 24-1-33 Santhanpāra 3,700 ft.; 361 ♂ 25-2-33 Peermade 3,200 ft.; 696 ♀ (juv.) 20-7-33, 799 ♂ (juv.) 6-8-33 (Thirūmalāi 120 ft.) Trivandrum Taluk; 869 ♂ 15-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.), Thattākād (200 ft.), Kottāyam (at ca. 100 ft.), Kūmili (3,000 ft.), Rājampāra (1,350 ft.), Tenmalāi (500 ft.), Balamore Estate (2,000 ft.), Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: *Adult and Immature* (No. 799): Iris creamy-white; upper mandible dark horny-brown except at gape; lower mandible, gape and mouth bright yellow; legs and feet dusky-yellow or yellowish-brown; claws dusky. *Juvenile* (No. 696—apparently younger than No. 799): Iris dark grey; legs patchy brown and yellow in front, yellow behind; rest as above.

[Measurements:

	Bill.	Wing.	Tail.
3 ♂♂	22.5-25	92-92.5	115-116.5 mm.
1 ♀	—	91	103.5 mm.

In juvenile plumage (Nos. 696 and 799) the wings and tail (full-grown) are considerably shorter: ♂ wing 83.5; tail 99; ♀ wing 85.5 mm.

The juvenile plumage is exactly similar to that of the adult except that the upper parts are a rather deeper richer brown.

Further specimens examined:

Bom. Nat. Hist. Soc. Coll.: ♀ 27-8-93 Thekadi, Travancore (J. P. Cook).

Brit. Mus. Coll.: 1 from Tirūmalāi, Trivandrum (A. N. Nair).—H. W.]

A fairly common species, flocks usually of 6-8 birds frequenting well-wooded areas and keeping mostly to dense scrub and secondary growth, preferably where intermixed with tall grass and on the edge of forest clearings. I did not meet it above 3,500 ft. It was usually shy and a great skulker, and beyond occasional fleeting glimpses, much oftener heard than seen. It has a series of squeaking notes, not unpleasant, something between those of *Argya caudata* and *Turdoides striatus*. Its food consisted very largely of Lantana berries, while in tea planting localities the flowers of the *Erythrina lithosperma* shade-trees invariably attracted flocks to the nectar, the birds obviously assisting in their cross-pollination. When venturing into the open branches of these trees, they were extremely wary, and dived headlong into the undergrowth on the slightest suspicion.

As pointed out in the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, 740) the distribution given in the *New Fauna* (vol. i, p. 202) is wrong. No mention is there made of its occurrence in Travancore-Cochin, while from Bett's account (*J.B.N.H.S.*, xxxiii, 543) where he confusedly records this species as *Argya caudata*, it would seem to be common in Coorg also.

Kinloch's failure to record it in the Nelliampathies was doubtless due to oversight. At Pādagiri—not far from the Palagapāndy Estate where he worked and from the Lily Downs referred to in his notes—I came across flocks on several occasions.

Breeding: The facts that two juveniles were obtained at the end of July and the beginning of August, that No. 869 (adult) was in complete moult in the middle of November, and the other two specimens were freshly moulted in January and February all suggest that the normal breeding season is later than is usually stated viz. February to May. It is, however, probably far from well-defined.

According to Bourdillon the usual nesting season in Travancore is March and April, but he also took a clutch of eggs on 23 February (*Nidification*, i, 164).

Pomatorhinus horsfieldii travancoriensis Harington. The Southern Scimitar Babbler.

Specimens collected: 5 ♂ 4-1-33, 10 ♀ 5-1-33 Marāiyūr 3,500 ft.; 144 ♂ 24-1-33 Santhanpāra at 4,500 ft.; 322 ♂ 21-2-33 Peermade 3,200 ft.; 392 ♂ 3-3-33 Kūmili 3,000 ft.; 673 ♀ 27-4-33 Balamore Estate 2,000 ft.; 885 ♀ 20-11-33 Kūriārkūtti at 2,500-3,000 ft.

Elsewhere noted at: Thattākād (200 ft.), Camp Derāmalāi (3,000 ft.), Rājampāra (1,350 ft.), Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris reddish-brown to brownish-crimson; bill yellow except basal half of culmen including nostrils, which horny-brown; mouth pinkish flesh-colour (in No. 392 yellow and brownish-pink!); legs and feet slaty or greyish-brown; claws horny-brown.

[Measurements:

	Bill.	Wing.	Tail.
6 ♂♂	28-31	93-98	97-106.5 mm.
7 ♀♀	28-31.5	89-98.5	93.5-100 mm.

Additional specimens examined:

Brit. Mus. and Bom. Nat. Hist. Soc. Colls.: ♂ 23-3-94, o? 10-4-94 Kodāikānal (J. P. Cook); ♂ 1-7-93 Pālnis (J. P. Cook); ♀ 14-5-17 High Wavy Mountains, Madūra District (S. H. Prater); ♀ 15-12-79, ♀ 20-4-80 Mynall 1,000 ft., Travancore (Bourdillon); ♀ 21-4-83 Pittūr, Pālnis (Terry); o? -3-75 Eridge, South Travancore (Hume Collection).

A very good race. Represented in Ceylon by the bright ferruginous race *melanurus* which is, however, clearly connected with *horsfieldii* by olive-brown intermediates. These ferruginous birds have the sides of the neck and fringe to the plastron identical in colour with those parts in *Pomatorhinus schisticeps*, and I think it is quite probable that *schisticeps* and its races might all be well considered races of *horsfieldii*.—H. W.]

The Scimitar Babbler is common in all evergreen and bamboo forest tracts throughout the area, whether up to 5,000 ft. in the hills (perhaps also higher) or in the low country as at Thattākād. Pairs or flocks of up to about ten birds (according to season) were met with either feeding on the ground in the undergrowth of *Strobilanthes*, wild *Zingiber* or Cardamom plants or up among the moss-covered branches of forest trees, and frequently as members of the localised bird associations or mixed hunting parties. They were also partial to thorny scrub, like *Acacia intsia* or *Lantana*, on the edge of hill-paddy 'toungya'), tea or cardamom clearings.

The members of the pairs or flocks keep in touch with one another by mellow bubbling or gurgling calls. When disturbed, the birds hop along the branches with great agility as if to get under weigh before taking off into the air.

In the Pālni Hills, Fairbank did not consider it abundant at Kodāikānal in June, judging from the calls (*S.F.*, v, 404).

This species is replaced in Ceylon by *P. melanurus* (vide H. W.'s note, *supra*).

Breeding: In specimen No. 885 (20 November) the ovarian follicles were considerably enlarged (damaged by shot!). There were no signs of moult, and a distinct incubation patch was present. The birds at this time were mostly seen in pairs.

In No. 5 (4 January) the testes measured 5×4 mm. It had a strip of something like the outer fibrous skin of a banana stem in its bill and was accompanied by its mate which was also carrying similar building material. This suggests that both sexes partake in nest building. They were working in a patch of thick impenetrable scrub consisting of *Lantana*, *Acacia intsia* and other thorny bushes. No. 10 (5 January) had a soft egg in the ovary, was one of a pair and breeding. On 15 January another bird was observed carrying fibrous strips of plantain bark into some dense scrub on a hillside. Nos. 322 (21 February) and 392 (3 March) also had somewhat enlarged testes, while 673 (27 April) had obviously finished breeding and was undergoing complete post-nuptial moult.

Bourdillon took many nests in Travancore and describes them as usually domed affairs made of leaves and grass, lined with roots. They are said to breed principally from December to February, but Stewart took one nest as late as 2 May. Both Stewart and Bourdillon say that c/2 or c/3 is the normal in this part (*Nidification*, i, 173-4).

From the evidence afforded by the Survey specimens, I am inclined to consider that in the Travancore-Cochin area, breeding commences rather earlier than has been recorded, i.e. by about the second half of November.

In the Pālnis, Terry (*S.F.*, x, 474) found a nest with 3 very hard-set and one 'fresh' (probably addled!) egg on 30 March, and another with 3 incubated eggs on 4 April. He identified the female shot off the latter as *melanurus*, doubtless misled by the rich colour of this race.

(On p. 211, vol. i, of the *Fauna*, it is stated about *P. h. horsfieldii*: 'This is a subspecies of the low country, it being represented by other races in the higher hills'. What is exactly meant by 'low country' is not clear; Mahāblēshwar and Khandālla are included in its 'Distribution', the former being 4,500 ft. and the latter about 2,000 ft.!).

Dumetia hyperythra albogularis (Blyth). The White-throated Babbler.

Specimens collected: 17 ♂ 5-1-33 Marāiyūr 3,500 ft.; 140 ♂ 24-1-33, 170 28-1-33 Santhanpāra 3,500 ft.; 345 o? 24-2-33, 359 ♀ 25-2-33 Peermade 3,200-3,500 ft.; 485 ♀ 21-3-33 Rājampāra 1,350 ft.; 652 ♂ 24-4-33 Balamore Estate 2,000 ft.

Elsewhere noted at: Kūmili and Periyār Lake Environs (3,000 ft.); Wadakkāncheri (400 ft.).

Colours of bare parts: Iris creamy-white; bill pale horny-brown, paler on lower mandible; mouth pale yellowish-flesh to pink varying apparently with age; legs and feet yellowish-flesh colour, duskier on anterior tarsus; claws brown.

[The sexed Survey specimens measure:

	Bill.	Wing.	Tail.
3 ♂♂	14.5-15.5	57.5-65	62-66 mm.
2 ♀♀	14	53.5	55.5-60.5 mm.

Further specimens examined:

Brit. Mus. Coll.: o? 16-3-75 Mate-ard (?), S. Travancore (Bourdillon); juv. -6-74 Lower Pālnis (Fairbank).

The juvenile specimen from the Lower Pālnis differs from the adult in having the whole upper plumage a brighter, more rufous brown with no chestnut on the forehead or crown. The lower plumage is a duller more fulvous brown with merely traces of white on the chin and throat and central abdomen, thereby affording a further proof—if more were needed than the respective distributions (as given in *J.B.N.H.S.*, xxxv, 743-745) and the existence of intermediates where they meet—that this bird is only a race of *D. hyperythra*.

Travancore specimens are not separable from those of the rest of Southern India. I have seen none from Ceylon.—H. W.]

This little babbler is generally distributed in the hilly portions of our area though it is by no means uniformly abundant everywhere. Ferguson is correct on the whole when he says that it is met with between 1,000 and 3,000 ft. elevation. I did not come across it in the low country at all, but a small flock was once noted on a dense scrub-covered side of a hummock in Cochin at about 400 ft. This, however, is the only record I have of its being found below 1,000 ft.

The birds frequent tall grass (*Andropogon*) and scrub country on hillsides, preferably in light deciduous forest, in flocks of seven or eight individuals. They are generally seen on the edge of paths or clearings in such facies, restlessly hopping about and diving among the grass stems and undergrowth in search of food, and uttering a low *swee-swee* of the volume of a Sunbird's calls varied by harsh tittering notes when agitated.

In Ceylon it is said to be tolerably common and generally distributed in all parts up to 5,500 ft.

Breeding: The only evidence is provided by No. 652 (24 April) whose testes measured 4×3 mm. and which looked as if it was preparing to breed. Most of the specimens procured in January and February were undergoing complete pre-nuptial moult.

Hume (*S.F.*, v, 404) records a nestling (presumably the one in the British Museum collected by Fairbank) from the Lower Pālnis in June. The season according to the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, 745) is not well defined and varies from the middle of April to the middle of November, irrespective of locality. According to the *Fauna* the principal breeding months in South India are June and July.

Pellorneum ruficeps granti Harington. The Travancore Spotted Babbler.

Specimens collected: 18 ♂ (imm.) 6-1-33, 26 o?, 27 ♂ 7-1-33, 99 ♂ (imm.) 15-1-33 Marāiyūr 3,500 ft.; 336 ♂ 23-2-33 Peermade 3,200 ft.; 503 ♂ 28-3-33 Tenmalāi 500 ft.; 878 ♂ 17-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Santhanpāra (3,500 ft.), Thattākād (200 ft.), Kūmili, Vandamettu or Wandamet, Periyār Lake Environs (ca. 3,000 ft.), Camp Derāmalāi (3,000 ft.), Rājampāra (1,350 ft.), Balamore Estate (2,000 ft.), Chālakūdi, Wadakkāncheri (400 ft.), Nemmāra (300 ft.), Pādagiri (3,000 ft).

Colours of bare parts: Iris hazel-brown (immature) to reddish-brown; bill upper mandible horny-brown, lower mandible usually somewhat paler; mouth in breeding ♂♂ (Nos. 336, 503, 878) brownish-pink, in immature yellowish flesh colour; legs and feet brownish flesh colour; claws duskier.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
4 adult ♂♂	19-20	73.5-76	66-73 mm.
2 imm. ♂♂	19	67-72	65-69 mm.

Further specimens examined:

Brit. Mus. Coll.: The type ♂ 10-3-77 Mynall; o? 8-1-01 Vandenmettu, Cardamom Hills (Ferguson).

A very good race, most markedly distinct from the typical form. The crown and nape are dark chestnut, the upper parts are dark olive brown, whilst the spotting on the lower surface is not only heavier but, with the dark wash on the flanks, is much darker brown than in the typical race.—H. W.]

The Spotted Babbler is generally distributed in all well-wooded areas throughout the two States. I came across it from 200 ft. above sea-level at Thattākād up to at least 6,000 ft. elevation in evergreen sholas on the hills surrounding Marāiyūr.

Pairs or family parties were usually met with in dense thickets and evergreen undergrowth by ravines and hill nullahs, the birds rummaging on the damp ground amongst the mulch and humus flicking the leaves here and there in their search for lurking insects. They were also partial to dense growths of Eeta bamboo (*Ochlandra travancorica*) especially on steep hillsides and along hill nullahs. In facies where a mixture of the evergreen and deciduous types of forest preponderated, their favourite haunts were the dry ravines and watercourses littered with rotting bamboos and brushwood and overgrown with thickets of *Acacia intsia*, *Zizyphus rugosa* and 'channa' or wild Zingiber etc.

On the whole it is an extremely shy bird, retiring into dense cover on the slightest suspicion, and is much oftener heard than seen. At Marāiyūr, however, I found it not only common but also surprisingly bold. It frequented the scrub and hedges about the petty Government offices and camp shed, and did not object to observation at close quarters.

Its percussive song of several rich and loud whistling notes was invariably heard in the early mornings and late afternoons wherever the birds were present. The notes more commonly uttered, however, are the ones I have elsewhere rendered as a somewhat plaintive *He'll beat you* or simply *He'll beat* which at times have a curiously ventriloquistic quality. Sometimes these are repeated from the branch of a tree in dense forest for well over five minutes at a stretch and without any variation. When the tree is approached, the bird ceases to call, noiselessly and imperceptibly drops down into the undergrowth below and disappears, and while you are still straining to catch a glimpse of it in the branches it calmly begins calling again 50 yards away! When alarmed, it gives vent to a series of sharp chuckling chirps or chirrups as it hurriedly moves away through the undergrowth.

In my opinion the statement based on Bourdillon's and Ferguson's accounts that the Spotted Babbler is rare in Travancore is untenable. In Cochin also I found it far from scarce in suitable localities and can confirm Kinloch's statement that it is common in the Nelliampathies.

Fairbank (*S.F.*, v, 404) frequently heard it in the Pālnis (sub-species?) but was never able to see one and procure a specimen.

In Ceylon the species does not occur.

Breeding: No. 878 (17 November) had the testes enlarged to 4×2 mm. (slightly pigmented) and from the freshness of its plumage it appeared to be getting ready to breed. No. 18 (6 January) was a juvenile with soft skull, completing its post-juvenal moult. No. 99 (15 January), also a juvenile with soft skull was in heavy post-juvenal body moult. Both these birds were members of family parties consisting of parents and two or three young. No. 336 (23 February) had testes measuring 7×4 mm. It was in freshly moulted plumage, one of a pair and evidently breeding. No. 503 (28 March)—testes 5×4 mm.—though moulting remiges was otherwise in fresh plumage and either breeding or about to.

The breeding season appears to commence about November and to continue till April or thereabouts. As is the case with most birds in the Travancore-Cochin area, it evidently begins considerably earlier than in other parts where, in the case of the typical race, March, April and May are given as the breeding months. Two clutches given by Stewart to Mr. Baker, c/4 and c/3 respectively, were taken on 7 June and 10 May (*Nidification*, i, 204).

Alcippe poioicephala poioicephala (Jerdon). The Nilgiri Quaker Babbler.

Specimens collected: 132 ♀ 23-1-33, 156 ♂ 25-1-33, 176 ♀, 177 ♂ 28-1-33, 192 ♀ (imm.) 30-1-33 Santhanpāra 3,500 ft.; 213 ♂ 4-2-33 Thattākād 200 ft.; 321 ♂ 21-2-33 Peermade 3,200 ft.; 364 ♀ 27-2-33 Kūmili 3,000 ft.; 876 ♂ 17-11-33, 890 ♂ 21-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Marāiyūr (Common between 6,000-7,000 ft.), Camp Derāmalāi (3,000-4,500 ft.), Rājampāra (1,350 ft.), Tenmalāi (500 ft.), Balamore Estate (2,000-4,000 ft.), Kuvallé Incline (Cochin Forest Tramway), Kūriārkūtti (up to 4,000 ft.), Pādagiri (3,000 ft.).

Colours of bare parts: *Adult*: Iris greyish-brown; bill dark horny-brown, commissure and lower mandible greyish; mouth pale flesh colour; legs, feet and claws greyish-brown. *Immature* (No. 192): Iris slaty-grey; gape and mouth bright yellow; chin duller yellow; paler portions of bill yellowish; legs, feet and claws as in adult.

[Further material examined:

Brit. Mus. Coll.: ♂ 4-4-79 Eridge; ♀ 12-12-78 Mynall; ♀ -9-74, o? -3-75 Eridge (Bourdillon); o? 9-1-01 Bandanutta [Vandamettu ?] (A. N. Nair).

Bom. Nat. Hist. Soc. Coll.: ♂ 1-7-93 Pulneys (J. P. Cook).

Measurements (including above):

	Bill.	Wing.	Tail.
8 ♂♂	15-16	68-73	60-67 mm.
6 ♀♀	15.5-16	65-70.5	61.5-64.5 mm.

A. p. brucei differs from this, the typical race, in being altogether paler. The crown and nape are a clearer colder grey; the rest of the upper parts are greyer and colder with less brown in them; the wings and tail are not so dark. The lower parts are also much paler, washed with greyer brown, as compared with rich fulvous. It is slightly larger; an equal number of birds measure:

	Bill.	Wing.	Tail.
8 ♂♂	15-17	69.5-77	64.5-70.5 mm.
6 ♀♀	15-16.5	67.5-73	61.5-69.5 mm.—H. W.]

It would perhaps be accurate to designate this Quaker Babbler as the commonest and most abundant bird species inhabiting the evergreen forest tracts of the States. I met with it from almost the level of the low country (Thattākād 200 ft. !) up to an elevation of 7,000 ft. in ravine sholas on Kūmarikkaimalāi near Marāiyūr.

The birds move about in parties of 7 to 10 individuals hunting insects among the foliage of the moss-covered trees, hopping about from sprig to sprig and often clinging upside down to peer into the angles of the leaf-stalks. They also descend lower down into the evergreen undergrowth of seedlings and cane-brakes, and almost invariably form the nucleus of the mixed hunting parties of small birds in the forest. At Kūriārkūtti they were common in the mixed bamboo forest as well as in the frequently intervening patches of evergreen.

The 'song' of four quavering whistling notes of the consistency of a Magpie Robin's, is repeated incessantly as the birds move about.

Like many other birds, I found them very partial to the nectar of *Erythrina lithosperma* flowers, and wherever these trees occurred shading coffee or tea on the edges of evergreen patches, parties were invariably observed probing into the blossoms. They must be added to the long list of bird species on which this tree is dependent for the cross-pollination of its flowers. A specimen shot in the act of eating nectar had pollen adhering to its chin and throat.

Kinloch appears to have overlooked this species in his list for the Nelliampāthies where I found it common.

In the Pālni Hills also it is common. Fairbank (*S.F.*, v, 404) observed it in wooded ravines on the hillsides.

The species is not found in Ceylon.

Breeding: No. 876 (17 November) appeared to be getting ready to breed. Its testes showed a slight development, while it was undergoing a complete (pre-nuptial ?) moult.

No. 132 (23 January) had a soft ovarian egg and some of the other follicles upto 4 mm. in diameter. It was in freshly moulted plumage.

No. 156 (25 January) testes 10×6 mm. Fresh plumage.

No. 176 (28 January) soft ovarian egg and follicles greatly enlarged. An incubation patch was present, and the bird was carrying a fine rootlet in its bill. No moult.

No. 177 (28 January) testes 9×6 mm. Fresh plumage.

No. 192 (30 January) juvenile with very soft skull. Out of nest, but being tended by parent.

No. 213 (4 February) testes 8×6 mm. Fresh plumage.

No. 321 (21 February) testes 9×7 mm. Moulting body and remiges. (Postnuptial ?).

On 25 April (Balamore, Ashāmbu Hills) a nest was discovered in a dense evergreen shola at ca. 3,000 ft. It was a flimsy cup of hair-like rootlets and some moss, slung hammock-wise between two horizontal twigs of a seedling at a height of about 4 ft. Diameter of cup ca. 70 mm.; depth 80 mm. It contained two naked chicks, one of which was observed at 7 a.m. pushing itself out of the shell. By 3-15 p.m. a fine fluffy down of pale yellow colour had made its appearance at various points on the back. The ground below the nest swarmed with leeches.

As is clear from the above, in Travancore-Cochin the breeding season lasts from January to May at least. That it may begin a month or so earlier is suggested by one of the Survey specimens, while it is said to continue till June. According to *Nidification*, i, 245, it breeds in Travancore principally in May and June, often April, while Stewart says he has taken eggs in every month of the year. Full clutch 2, rarely 3 eggs, but A. P. Kinloch took several c/3 at Kollengode and considered this the normal there.

At Culputty, South Wynaad, Mr. Darling, Junior, found a nest as late as October.

Rhopocichla atriceps bourdilloni (Hume). Bourdillon's Babbler.

Specimens collected: o? 10-1-33 Marāiyūr (at 6,000 ft.); 159 ♂, 160 ♂ 25-1-33; 169 ♂ (imm.) 28-1-33, 197 ♂ (imm.) 31-1-33 Santhanpāra 3,500 ft.; 223 o? (imm.) 6-2-33 Thattākād 200 ft.; 323 ♂ 21-2-33 Peermade 3,200 ft.; 363 ♂ 27-2-33 Kūmili 3,000 ft.; 426 ♀ 9-3-33 Camp Derāmalāi 3,000 ft.; 477 ♀ 20-3-33 Rājampāra 1,350 ft.; 494 ♂, 495 ♀ 26-3-33 Tenmalāi 5,000 ft.; 645 ♂ 23-4-33 Balamore Estate 2,000 ft.; 822 o? 10-8-33 Kūtyāni 300 ft. Trivandrum Talūk; 873 ♀ 16-11-33 Kūriārkūtti 1,600 ft.; 994 ♀ 19-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Mūndakāyam (in Ūrūmbikera Reserve Forest), Wandamet, Kūvallé Incline (along Cochin Forest Tramway).

Colours of bare parts: Iris lemon yellow or pale golden yellow; upper mandible dark horny-brown; commissure and lower mandible pale greyish flesh colour; mouth *adult* pale pinkish-flesh, *immature* mouth and gape yellow; legs and feet pinkish-grey; claws dusky.

[The sexed Survey specimens measure:

	Bill.	Wing.	Tail.
8 ♂♂	15-16	55-60.5	46.5-51 mm.
5 ♀♀	14-15	54-58	43-48 mm.

In the Eastern Ghats Survey I expressed certain doubts as to whether two races *atriceps* and *bourdilloni* should be recognised, for the following reasons: (1) that *bourdilloni* exhibited characters which might suggest that it was the juvenile plumage of *atriceps;* (2) that both forms were stated to occur throughout the Travancore hills; and (3) that Trichoor, the usually accepted type-locality of *atriceps* was in the area which geographically should be occupied by *bourdilloni.*

The question has now been cleared up by the fine series collected by Mr. Sálim Ali. This shows that the juvenile and adult birds of this race are alike in colouration, both being brown-headed. It also shows that there is a certain amount of variation in the colour of the crowns, some being browner and others blacker. This is to be expected, as *bourdilloni* is an intermediate form between *atriceps* and *nigrifrons*, and it no doubt explains Ferguson's statement that both forms occur throughout the Travancore Hills, though *atriceps* is far less common (*J.B.N.H.S.*, xv, 260). No true *atriceps* was met by the Surveys.

As regards the type-locality of Trichoor for *atriceps,* the two Survey specimens from Cochin State are beyond all doubt *bourdilloni* and it therefore appears very highly probable that birds from Trichoor must belong to the same form and not to *atriceps.* None are, however, available for examination. It must be remembered moreover, that Jerdon only recognised one form. His original description most clearly refers to typical *atriceps* with the black head, but his localities no doubt refer to both forms for he says: 'I have seen it in the Trichoor and Wurguncherry [Wadakkancheri ?] jungles and also on the Coonoor Ghat and in the Wynaad' and in the *Birds of India* (vol. ii, p. 19) whilst still only recognising one form he expands his localities to include 'all the forests of Malabar', that is the Malabar Coast.

Trichoor was only selected later as type-locality as it was the first locality mentioned, but since it appears certain that this locality is within the range of the southern form, the type-locality must be shifted to one of the other places mentioned by Jerdon. I accordingly designate the Wynaad as the type-locality.

I may mention that this is one of the species in which 'museum browning' is very marked—fresh birds being much more olive in tint than birds kept for some years.—H. W.]

Bourdillon's Black-headed Babbler is essentially a bird of evergreen forest and is met with wherever patches of this occur, from the level of the low country up to an elevation of at least 6,000 ft. in the hills. It goes about in flocks of from 5 to 10 birds, keeping to dense undergrowth of rattan (*Calamus*) and seedlings or *Strobilanthes* especially by the edge of paths or clearings, and seldom ascends higher up into the trees. So narrowly is it confined to evergreen jungle that I frequently came across it in sholas bordering the ravines amongst the grassy hilltops at Wandamet (Cardamom Hills) often barely half an acre in extent and separated from the next, no bigger than itself, by a mile or more of open rolling grass-covered 'downs'. At Kūtyāni in the environs of Trivandrum town where tiny patches of evergreen occur between hummocks covered with tapioca and plantain cultivation (with paddy-fields in the intervening narrow flats or valleys) and sundered by miles from the nearest evergreen patch of any size, this species has persisted in virtual isolation since at least 1903 when Ferguson recorded meeting it in these 'serpent groves', most of which have by now disappeared.

At Kūriārkūtti, the birds were commonly observed in mixed bamboo forest on the verge of evergreen jungle, amongst dense scrub and thickets.

A harsh, rather subdued *chur-r*, *chur-r*, etc., something like similar notes of the Iora, is uttered as the flocks move about the undergrowth very much in *Dumetia* fashion, and the birds have a habit—having ventured too far up in a cane-brake or the like—of dropping perpendicularly like a falling leaf into the thickets below on the slightest alarm or suspicion.

Fairbank does not seem to have come across it in the Pālnis though it is more than likely that it occurs in those hills.

The Ceylonese race *R. a. nigrifrons* is found throughout that island.

Breeding: Nos. 169 (28 January), 197 (31 January) and 223 (6 February) were all immature birds with very imperfectly ossified skulls, juvenile gape and mouth and Nos. 169 and 223 were undergoing heavy post-juvenal body moult. They were evidently between 1½ and 2½ months old. No. 477 (20 March) had conspicuously granular ovaries; it was in fresh plumage and appeared ready to breed. The gonads of the other specimens gave no indication as regards the breeding season, but it seems from the evidence that this is by no means so well defined as has been described ('March to May, July and August', *Fauna*, vol. i, p. 282) and the statement in the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, 749) that breeding continues throughout the year is probably more correct.

T. F. Bourdillon (*S.F.*, ix, 299-300) took a nest at Mynall (4,300 ft.) in South Travancore on 24 March in a low bush at about 18 in. from the ground. He describes it as a domed structure, very similar to the nest of *Ochromela nigrorufa* but slightly larger, composed externally of 'Irul' [meaning doubtless Eeta (*Ochlandra*)] leaves and lined with fine hair-like roots. The eggs [number ?] were white, very sparingly spotted with purple except towards the larger end where the spots coalesced to form an imperfect zone.

According to *Nidification* (i, 254) most eggs in Travancore are laid in April, May and June, though Stewart has taken them in every month. c/2 is said to be normal, c/3 unusual.

Ægithina tiphia multicolor (Gmelin). The Ceylon Iora.

Specimens collected: 78 ♂ 13-1-33 Marāiyūr 3,500 ft.; 168 ♂ 26-1-33 Santhanpāra 3,500 ft.; 219 ♀ 4-2-33 Thattākād 200 ft.; 467 ♀ 18-3-33 Rājampāra 1,350 ft.; 490 ♂ 25-3-33 Tenmalāi 500 ft.; 636 ♀, 637 ♂ 21-4-33 Arāmboli 250 ft.; 692 ♂ 20-7-33, 721 ♀ 25-7-33 (Thirūmalāi 100 ft.); 748 ♂, 749 ♀

30-7-33 (Veli 130 ft.); 791 ♂ 5-8-33 (Poojappūra 140 ft.); 811 ♀ 8-8-33 (Mūkūnnimalāi 800 ft.) Trivandrum Environs; 964 ♀ 10-12-33 Nemmāra 300 ft.; 1034 ♂ 28-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Kottāyam (50 ft.), Peermade (3,200 ft.), Kūmili (3,000 ft.), Camp Derāmalāi (3,000 ft.—Panthalam Hills), Trivandrum Town, Cape Comorin (S.L.), Balamore Estate (2,000 ft.—Ashāmbū Hills), Kūriārkūtti (1,600 ft.), Wadakkāncheri (400 ft.), Pādagiri (3,000 ft.—Nelliampathy Hills), Trichūr, Ernakulam.

Colours of bare parts: Iris greyish- or silvery-brown; bill bluish-plumbeous, black on culmen; palate greyish-blue, gullet slaty-brown, brownish-black or slaty-pink in adult; legs and feet slaty-grey; claws brown.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
9 ♂♂	17-19	63-68.5	45-51 mm.
7 ♀♀	16.5-19	61-66	47.5-52.5 mm.

Owing to the courtesy of the Director of the Colombo Museum, I have been able to examine a further series of 8 specimens of the Iora from Ceylon and these, taken in conjunction with the series in the British Museum, lead me to the conclusion that the darker and duller green of the upper parts of the female and the male in 'winter plumage' is the only satisfactory feature on which this race can be maintained. The only specimens from Travancore in the British Museum are the unsatisfactory 'Anjango' series of which only one shows the green back. I have carefully compared the good series obtained by the Surveys with these Ceylon specimens and also with an ample series of *Æ. tiphia humei* and find that the Travancore series are as a whole intermediate between the others. This being so—and it is interesting to note that No. 964 from Nemmāra in the Pālghāt Gap is quite indistinguishable from *Æ. t. humei*—I think it is of value to mark the connection between the Travancore area and Ceylon by including these intermediates under the name of the Ceylon race. There is of course no difference between the birds of Northern and Southern Travancore and these Travancore intermediates merely represent a phase of the general intergradation from north to south which I emphasised in my account of this species in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, 750).

The series suggests that the breeding season of the Iora in Travancore is quite undefined; at any rate, accepting the usual definition that the black head and back of the male represent the breeding season and the green upper parts the non-breeding season. I find that No. 78 (13 January) is in winter plumage and Nos. 168 (26 January) and 1034 (28 December) are in breeding plumage, whilst No. 931 (1 December) is moulting into breeding plumage. Legge evidently found the same state of affairs in Ceylon and was thereby led to suggest that the black upper parts might be merely connected with age. I do not think the latter explanation necessary, however, in view of the connection between the breeding seasons and the plumage in other areas where the breeding season is more clearly defined.—H. W.]

The Iora is a common bird throughout the area from about sea-level to at least 3,500 ft. in the hills, and possibly even higher up to some extent, though at Mūnnār (5,000 ft.—Kannan Dēvan Hills) it was noted as absent. At Kotāgiri in the Nilgiris, I observed it at 5,500 ft. Ferguson does not seem to have met with it except in the low country where it is certainly more abundant. This is probably the basis for the statement in the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, 749) that 'In the south-west it seems to be more definitely a bird of the plains as it avoids the Pālni Hills and the Travancore ranges south of the Pālghat Gap'.

It is a bird of light secondary or deciduous-and-bamboo jungle and avoids evergreen forest. Its favourite haunts, however, are the mango, jack and cashew gardens about villages and homesteads in the low country, and it is also quite at home in the gardens and compounds of the larger towns such as Trivandrum, Trichūr and others.

Fairbank (*S.F.*, v, 406) only obtained a specimen at the base of the Pālni Hills and does not record it higher up. The species and race are abundant in Ceylon.

Breeding: No. 931 (1 December) was completing body moult into breeding plumage though its gonads as yet showed no development. No. 1034 (28 December) had acquired fresh breeding plumage, its testes measured 6×4 mm. (grey pigmented) and it was evidently ready to breed.

In No. 78 (13 January) the testes—ca. 2×1.5 mm.—were apparently reverting to normal non-breeding condition as the specimen was in freshly moulted non-breeding plumage. No. 168 (26 January) on the other hand was evidently ready to breed. It was completing pre-nuptial moult and had testes measuring 8×5 mm. At this time other males in breeding dress were also calling from bare branches etc. in loud melodious whistles, and displaying. No. 219 (4 February) had a firm granulated ovary and on 9 February a male in *non-breeding* plumage was observed fluffing out the white rump feathers, slightly cocking up tail, drooping wings at sides and displaying before a female in rivalry with another cock in breeding dress. If the above evidence be admissible, and I have frequently observed this on other occasions also—then Hume's statement (*S.F.*, v, 430) that cocks sometimes breed in female plumage *may*, after all, be correct. On 4 March the birds were noted as busy courting and displaying and No. 490 (25 March) had testes enlarged to 6×4 mm.

Ferguson took nests in the Public Gardens at Trivandrum in April, and one of the specimens obtained by Pillai in that neighbourhood on 8 August (No. 811) was immature with an imperfectly ossified skull and undergoing post-juvenal body moult, therefore about 2-2½ months old.

From the evidence cited above it is clear that the breeding season of the Iora in the Travancore-Cochin area is irregular and much prolonged, extending from about January to June for certain, and sporadically over the greater part of the year.

Chloropsis aurifrons insularis Kinnear and Whistler. The Gold-fronted Chloropsis.

Specimens collected: 65 ♀, 66 ♂ 11-1-33 Marāiyūr 3,500 ft.; 189 ♂, 190 ♂ (juv.) 30-1-33 Santhanpāra 3,500 ft.; 444 ♀ 16-3-33 Rājampāra 1,350 ft.; 499 ♀ (imm.) 27-3-33 Tenmalāi 500 ft.; 899 ♂ 25-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Thattākād (200 ft.), Kūmili (3,000 ft.), Nemmāra (300 ft.), Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: *Adult*: Iris hazel brown; bill in ♂ black, ♀ horny-brown; mouth pinkish-flesh to slaty-pink; legs and feet grey or plumbeous; claws brown. *Juvenile*: Bill pale horny-brown; mouth vivid pink; rest as in adult.

[Measurements of 12, including Survey series:

	Bill.	Wing.	Tail.
7 ♂♂	22.5-25	86.5-93.5	65-69 mm.
5 ♀♀	22-23	84.5-90.5	64.5-67 mm.

For plumages see Eastern Ghats Report, *J.B.N.H.S.*, xxxv, 752.

In the Eastern Ghats Survey the name *Chloropsis aurifrons davidsoni* Stuart Baker was used for the race of this species found in Southern India exclusive of the range of *C. a. insularis*. This was a name proposed by Mr. Stuart Baker, *Bull. B.O.C.*, xli (1920), p. 8, in place of *Chloropsis malabaricus* (Gmel.) pre-occupied. Dr. Sassi has, however, since shown [*Bull. B.O.C.*, liii (1932), p. 44] that this race should be known as *Chloropsis aurifrons frontalis* (Pelzeln) as it was so described by Pelzeln in Sitzungsberichte der Mathem.-naturwiss. Klasse der Kaiserl. Academie der Wissenschaften in Wien, Tome, xx (1856), p. 157, pl. ii, fig. i. The type is an adult male in the Vienna Museum collected at Khelgate near Goa by Baron Huegel. *C. a. davidsoni* Stuart Baker will therefore stand as a synonym.—H. W.]

This Chloropsis is fairly common throughout the States inspite of Ferguson's statement that it is not found in the low country. I came across it from about 200 ft. (Thattākād) up to an elevation of 3,500 ft. in the hills of both Travancore and Cochin. My impression is that this species prefers more thickly wooded country than Jerdon's Chloropsis. Thus, at Thattākād where patches of dense evergreen forest and open deciduous and secondary jungle occur in juxtaposition, *aurifrons* was more or less confined to the former and *jerdoni* to the latter. The birds were usually met with in pairs, but family parties of 3 or 4 were not uncommon.

In addition to insects, spiders and berries, its food consists to a large extent of the nectar of flowers. I frequently, and regularly, observed it probing with its bill into blossoms of the following species which it doubtless plays a considerable part in cross-pollinating:

Musa (*sapientum*?),
Mucuna pruriens (pollen on forehead!),
Erythrina lithosperma and *E. suberosa,*
Loranthus longiflorus,
Mezoneuron cucullatum (var. *grandis*).

Fairbank does not record the Gold-fronted Chloropsis in his Pālnis list (*S.F.*, v). The race *insularis* is generally distributed in Ceylon up to 4,000 ft.

Breeding: Specimen No. 899 (25 November) was completing pre-nuptial moult and its testes were enlarged to 4×3 mm. On 30 November a male (?) was observed feeding a full-fledged young in which latter the black gular patch and blue moustachial streaks were as yet absent. Nos. 65 and 66 (11 January) were a pair. The ovary of the female was distinctly granular (follicles about 1 mm. in diameter) while the testes of the male measured 5×3. The birds were in fresh plumage except for a light moult on the female's breast, and were evidently ready to breed.

No. 189 (30 January—testes ca. 4×3 mm.) was the parent of No. 190 and was busy feeding the latter on a tree in dense scrub jungle. The young was probably less than a week out of nest. Its skull was papery and rectrices, remiges and tectrices only partly grown.

Specimens shot on 16 and 27 March showed no genital development and were undergoing complete post-nuptial (?) moult, in the latter only tail and body.

The breeding season in this area is apparently from about November to February.

Chloropsis jerdoni (Blyth). Jerdon's Chloropsis.

Specimens collected: 246 ♀, 247 ♂ 8-2-33 Thattākād 200 ft.; 688 ♀ 18-7-33 (Pūlayanār Kotta 300 ft.); 740 ♂ 29-7-33 (Kūttāni 300 ft.); 783 ♀ 4-8-33 (Cattle Farm); 808 ♀ 8-8-33 (Mūkūnni Malāi 800 ft.); 815 ♂ (Nettāyam 200 ft.) Trivandrum Environs; 1017 ♂, 1018 ♀ 26-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Marāiyūr (3,500 ft.), Kottāyam (S.L.), Ūrūmbikera Reserve Forest (ca. 1,000 ft.—near Mūndakāyam), Kūmili (3,000 ft.), Arāmboli (250 ft.), Balamore Estate (2,000 ft.), Kūriārkūtti (1,600 ft.).

I noted it as absent at Rājampāra where only *aurifrons* seemed to occur.

Colours of bare parts: Iris hazel brown; bill ♂ black, ♀ horny-brown, grey at sides of base of lower mandible; mouth pinkish-grey or pinkish-slate; legs and feet slaty-grey; claws dusky.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
3 ♂♂	23-24	87-90.5	69.5-72.5 mm.
6 ♀♀	22.5-23.5	83.5-86.5	66.5-69.5 mm.

Plumages given in Eastern Ghats Report, *J.B.N.H.S.*, xxxv, 753.—H. W.]

Jerdon's Chloropsis is fairly common in the drier parts of the area. It inhabits open deciduous country, secondary scrub, groves of jack, cashew, mango etc. and pepper cultivation about homesteads, and avoids densely wooded tracts. Ferguson states that it does not ascend the hills; I however, met it up to an elevation of 3,500 ft. In food and habits it does not differ to any appreciable extent from the foregoing species. In several localities in Cochin I found it a wholetime attendant on the blossoms of *Helicteres isora,* probing into them for the nectar.

In the Pālnis, Fairbank (*S.F.*, v, 406) obtained a specimen at 4,000 ft. in the lower hills. In Ceylon Jerdon's Chloropsis is fairly generally distributed up to 3,500 ft.

Breeding: Nos. 1017 and 1018 (26 December), a pair, were certainly breeding. The testes of the one measured 5×3 mm., while the ovarian follicles of the other were considerably enlarged, the largest measuring 5 mm. in diameter. In Nos. 246 and 247 (8 February), also a pair, the ovarian follicles were about 1 mm. and the testes ca. 4×3 mm. They were undergoing pre-nuptial body moult—more advanced in the male than in the female—and evidently preparing to breed.

Two of the specimens collected by Pillai (Nos. 783 and 815) on 4 and 9 August in the environs of Trivandrum town had imperfectly ossified skulls from which it would appear that the breeding season, commencing probably about November as in the foregoing species, continues till at least June, and perhaps later.

Family: Pycnonotidae.

Microscelis psaroides ganeesa (Sykes). The Southern Indian Black Bulbul.

Specimens collected: 112 ♀ 19-1-33 Mūnnār 5,000 ft.; 659 ♂ (imm.) 25-4-33 Mūthūkūzhi 3,500 ft.; 974 ♂ 13-12-34 Pādagiri 3,000 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.), Santhanpāra (3,500 ft.), Peermade (3,200 ft.); Camp Derāmalāi (3,000 ft.), Balamore Estate (only above 2,500 ft.).

Colours of bare parts: *Adult*: Iris orange-brown; bill bright deep orange; mouth orange and pink; legs and feet yellowish-orange; claws horny-brown. *Immature*: Iris olive-brown; bill horny-brown, paler at tip; gape yellow; mouth yellowish-pink; legs and feet yellowish-brown; claws horny-brown.

[Measurements of 11 including Survey specimens:

	Bill.	Wing.	Tail.
7 ♂♂	26-28.5	117.5-124.5	98-105 mm.
4 ♀♀	26-28.5	112-123	96.5-104.5 mm.

Further specimens examined:

Brit. Mus. Coll.: ♂♂ 21-6-77 Kodaikānal 7,000 ft., ♀ 1-6-77 Pālnis (Fairbank); ♂ 21-12-79, ♂ 24-12-79 Nangand (?), ♀ 29-11-78 Mynall (Bourdillon).

Bom. Nat. Hist. Soc. Coll.: ♂ 18-8-93 Thekadi (J. P. Cook).

H. Whistler Coll.: ♀ 26-10-23 Nelliampathies 3,500 ft. (A. P. Kinloch).—H. W.]

The lowest elevation at which the Surveys came across the Black Bulbul was about 2,500 ft. and it is a common species in all the hills from 3,500 ft. up. Ferguson records once having met a large flock as low down as 1,500 ft., while according to Bourdillon it is 'found also in small numbers at the foot of the hills'. This latter must surely be an extremely rare occurrence.

The birds go about in noisy flocks of 6 to 12, often considerably larger, and usually keep to the tall tree-tops or the higher branches of forest trees, whence they may frequently be seen launching short twisting sallies after winged insects. *Eucalyptus* trees are much favoured, and I observed both in these hills—wherever the tree has been introduced—and in the Nilgiris, that the birds regularly visited the white 'brush-like' flowers principally for the attending insects but also occasionally sipping the nectar. Some of the commonest members of the localised bird associations or hunting parties in the sholas at about 5,000 ft. were: *Microscelis, Zosterops, Sitta frontalis, Culicicapa, Pomatorhinus, Trochalopteron* (frequently), *Muscicapula pallipes, Ochromela nigrorufa*. The first usually kept to the tree-tops or higher branches, the last two to the evergreen undergrowth of seedlings etc. while the remaining hunted indiscriminately between these two 'zones'.

The nectar of *Erythrina lithosperma* is much sought after by Black Bulbuls, and the shade trees on coffee estates in the higher hills were in constant attendance by noisy flocks. I found them also feeding largely on the ripe drupes of *Zizyphus œnoplia* (at Marāiyūr) and on Jāmūn (*Eugenia* sp.) and *Vaccinium Leschenaultii* ('Bilberries').

In the Pālnis, Fairbank (*S.F.*, v, 405) found them in groves both at the tops of the hills and lower down. In June they were in noisy flocks of 20 to 30 birds. Terry (*S.F.*, x, 476) also came across them on 2 or 3 occasions at Pulungi. In the Nelliampathies where they are extremely common, Kinloch found that the flocks broke up into pairs about February. This Bulbul is represented in Ceylon by the race *humii* which has a larger bill.

Breeding: In No. 974 (13 December) the testes were undeveloped. No. 112 had a distinctly granulated ovary, the follicles measuring about 1 mm. in diameter, and the bird was in somewhat worn plumage. At this time pairs were observed in courtship. No. 659 (25 April) was immature (with very imperfectly ossified skull) undergoing post-juvenal body moult. On 17 July at Kotāgiri (Nilgiris) I found them feeding full-fledged young similar to No. 659, generally.

In Travancore Stewart found them breeding at between 4,000 and 6,000 ft. elevation in dense forest, principally in April and May. Kinloch also records the same to be the chief breeding months in the Nelliampathies (*Nidification*, i, 343).

Molpastes cafer cafer (Linn.). The Ceylon Red-vented Bulbul.

Specimens collected: 261 ♂ 10-2-33 Thattākād 200 ft.; 564 ♂ 11-4-33 Cape Comorin ca. S.L.; 691 ♂ 20-7-33 (Marūthānkūzhi 50 ft.); 752 ♀ 30-7-33 (Thirūmalāi 120 ft.) Trivandrum Environs; 951 ♂ 7-12-33 Nemmāra 300 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.), Kottāyam (ca. S.L.), Rājampāra (1,350 ft.—Panthalam Hills), Trivandrum Town, Arāmboli (250 ft.), Chālakūdi, Wadakkāncheri (400 ft.), Karūpadanna (ca. S.L.).

Noted as absent at: Mūnnār (5,000 ft.), Santhanpāra (3,500 ft.), Kūriārkūtti (1,600 ft.), Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris brown; bill brownish-black; mouth pinkish yellow; legs, feet and claws blackish-brown.

[Measurements of 9 including Survey specimens:

	Bill.	Wing.	Tail.
7 ♂♂	19-21	92.5-98	76-84 mm.
2 ♀♀	18.5-21	91.5-98.5	83 mm.

Further material examined:

Brit. Mus. Coll.: ♂ 18-11-78, ♂ 19-11-78 Trivandrum (Bourdillon); ♂ 27-5-77 Vengāyam Parry, E. base of Pālnis (Fairbank); ♀ 28-2-75 Kolāchal, Travancore.—H. W.]

The distribution of the Red-vented Bulbul in the area covered by the states of Travancore and Cochin is peculiar and worthy of closer scrutiny. The precise ecological factors that control it are obscure. I met it from about sea-level to an altitude of 4,000 ft., but on the whole it would perhaps be correct to say that it avoids elevations over 1,500-2,000 ft. and also country that is densely wooded. In the Nilgiris, however, I found it common up to 5,000 ft. At Thattākād a sharp division between the biotopes of this Bulbul and the Red-whiskered species was clearly noticeable. In the mixed evergreen-and-deciduous forest patches none of the former were in evidence though the latter were abundant, while as soon as one reached dry deciduous-and-scrub country the tables were turned and *Otocompsa* almost completely disappeared. It was more or less the general rule for the two to replace each other in the localities and biotopes suited to them.

The following table expresses as nearly as possible their respective positions in Travancore and Cochin.

Locality.	*Molpastes.*	*Otocompsa.*
Marāiyūr, 3,500 ft.	Common	Common.
Mūnnār, 5,000 ft.	Absent	Common.
Santhanpāra, 3,500 ft.	Absent	Common to very common.
Thattākād, 200 ft.	Not common	Common.
Kottāyam, ca. 50 ft.	Common	Much less common.
Peermade, 3,200 ft.	Absent	Very common.
Kūmili, 3,000 ft.	Very scarce (Only 3 !)	Common.
Camp Derāmalāi, 3,000 ft.	Absent	Fairly common.
Rājampāra, 1,350 ft.	Fairly common	Fairly common.
Tenmalāi, 500 ft.	?	Fairly common.
Trivandrum Town	Common	Common.
Cape Comorin	Fairly common	Absent.
Aramboli, 250 ft.	Common	Absent.
Balamore Estate, 2,000 ft.	Absent	Common.
Chālakūdi	Fairly common	?
Kūriārkūtti, 1,600 ft.	Absent	Not common.
Wadakkāncheri, 400 ft.	Common	Not common.
Nemmāra, 300 ft.	Common	Absent.
Pādagiri (from 1,500 ft. up)	Absent	Very common.
Karūpadanna	Fairly common	Not common.

The food of this species in common with that of the rest of the *Pycnonotidae* consists chiefly of fruits and berries. The following are some of the species observed to be patronised as and wherever available: *Zizyphus oenoplia, Maesa perrottetiana, Eugenia jambolana, Vaccinium Leschenaultii, Salvadora persica, Polygonum chinense* L., *Trema orientalis* Blume, *Berberis tinctoria* Lesch., *Lantana camara*, also figs of *Ficus bengalensis, F. religiosa* and *F. glomerata*. A great many others are also eaten and there is no doubt that this group is of the greatest importance in the dispersal of the plants. I also observed these Bulbuls regularly eating nectar from flowers of *Erythrina lithosperma, Bombax malabaricum, Loranthus longiflorus, Grevillea robusta* and other species.

In the Pālnis both Fairbank (*S.F.*, v, 405) and Terry (*S.F.*, x, 476) found the Red-vented Bulbul somewhat rare as compared with *Otocompsa* at the top of the hills, but more abundant down the slopes and in the adjacent plains.

The same race, *cafer*, occurs in Ceylon throughout the low country and at medium elevations in the hills, becoming rarer higher up.

Breeding: On November 25 (Wadakkāncheri) a bird was observed carrying nesting material in its bill. In No. 261 (10 February) the testes—ca. 3×2 mm. —appeared to be developing and the bird was completing pre-nuptial moult (?). On 19 April (Arāmboli) a nest in a *Thespesia populnea* tree at 10 ft. contained two chicks about 5 days old, with quills sprouting, and one addled egg. Both parents were busy feeding the young (on berries !).

The gonads of the two specimens obtained in July were also slightly developed, but from their plumage they appeared to have finished breeding.

Ferguson took a nest with 2 eggs on 29 March and mentions another in the Public Gardens at Trivandrum which contained 3 young birds at the end of April. According to him, the breeding season in Travancore is February to May. T. F. Bourdillon took nests with eggs in May and June (*Nidification*, i, 354).

Probably as elsewhere in its range, there is really no well-defined season and the breeding period fluctuates considerably on either side of the above extremes.

Otocompsa jocosa fuscicaudata Gould. The Southern Red-whiskered Bulbul.

Specimens collected: 341 ♂ (juv.) 23-2-33 Peermade 3,200 ft.; 650 ♀, 651 ♂ 23-4-33 Balamore Estate 2,000 ft.; 686 ♀ 18-7-33, 831 ♂ 11-8-33 (Pulayanārkotta 200 ft.); 855 ♂ 30-7-33 (Thirūmalāi 100 ft.) Trivandrum Environs; 887 ♂ 21-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: See table under *M. c. cafer*.

Colours of bare parts: Iris hazel-brown to brown; bill horny black; mouth orange-yellow and pink; legs, feet and claws horny brown.

[The Survey specimens measure:

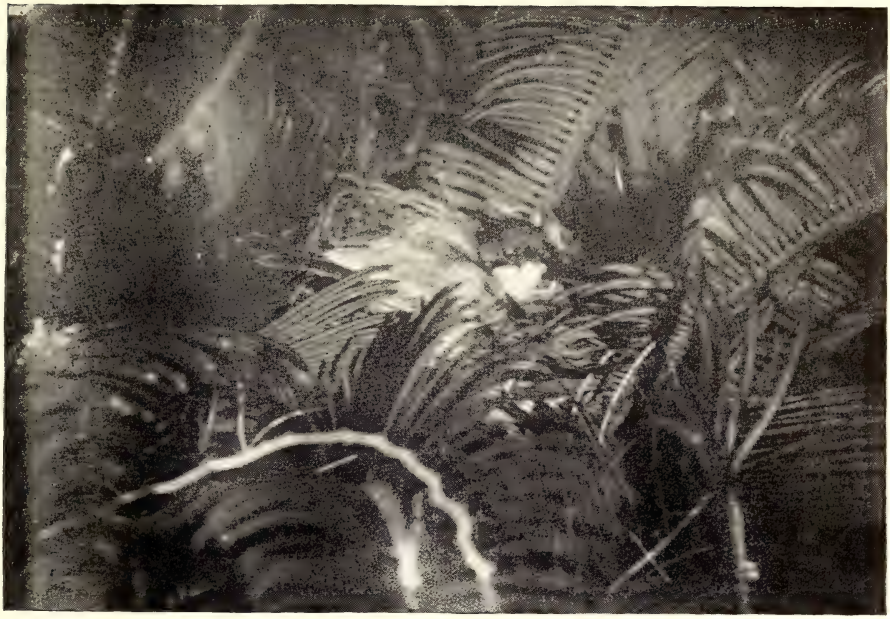
	Bill.	Wing.	Tail.
4 ♂♂	18.5-20.5	83.5-89	79-84 mm.
2 ♀♀	18-18.5	81-83	77-80 mm.

No. 341 is in juvenile plumage. This is very similar to the adult but the crest is shorter and browner, a less pure black; the red 'whisker' patch is absent; the upper parts are duller, more rusty in colour and the gorget is duller; the undertail coverts are dull pinkish. The first primary is softer and more rounded, while the outer tail feather is narrower and more pointed at the tip.—H. W.]

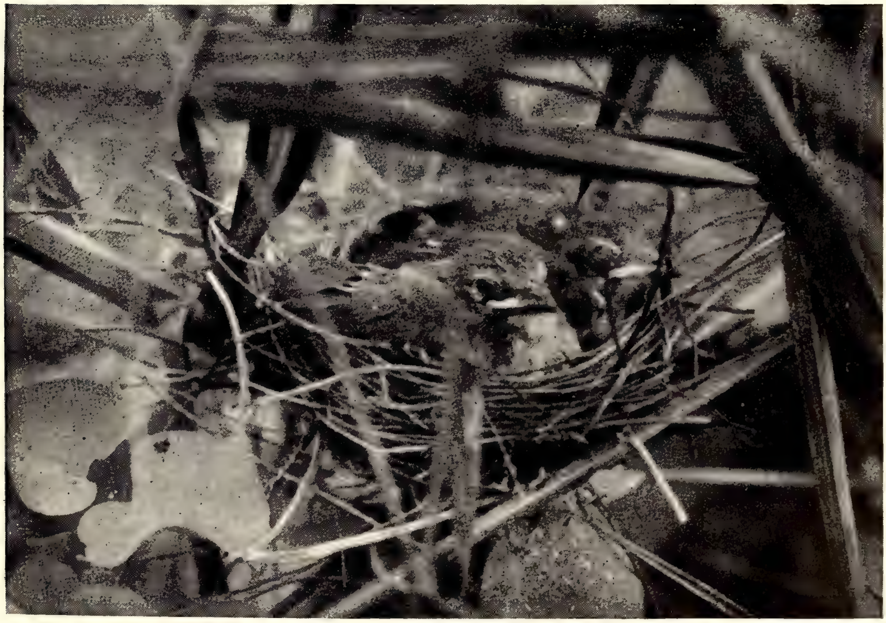
The distributional peculiarities of this Bulbul in the Travancore-Cochin area have already been dealt with above.

In the Pālni Hills both Fairbank (*S.F.*, v, 405) and Terry (*S.F.*, x, 476) found it extremely common on the tops of the hills and extending right down to the bottom. This species is absent in Ceylon.

Breeding: In No. 887 (21 November) the testes measured 3×2 mm. and appeared to be developing. On 25 January (Santhanpāra) 2 nests were discovered in small bushes in an open patch of brushwood on the verge of a cardamom shola, each containing c/2. One egg from either clutch measured 23×16 mm. A third nest was situated in the thatch of a tenanted hut, containing c/2 on 30 January. During the night one of the eggs hatched. At



Red-whiskered Bulbul (*Otocompsa emeria*) on nest in Cycad palm.



Nest of White-browed Bulbul (*Pycnonotus luteolus*) with chicks 9 days old.

Photos by Author.

this time full-fledged young, recently out of nest, were observed on all sides being fed (on insects and various *Fici*) and fussed over by the parents.

On 11 February a fourth nest was located on the bank of the Periyār River at Thattākād, in a branch of Eeta bamboo overhanging the water's edge. It was at a height of 5 ft. from the ground and contained c/2.

Specimen No. 341 (23 February) was juvenile with very soft skull and evidently not more than 3 weeks to a month old. On the same date an adult bird was observed carrying nesting material.

On 9 March (Camp Derāmalāi) a pair were building in a small tree at ca. 7 ft. a couple of yards from a residential bungalow. In the pair shot at Balamore Estate on 23 April (Nos. 650 and 651) the largest ovarian follicle measured 7 mm. in diameter while the testes of the male were enlarged to 5×4 mm. and the birds were obviously breeding. From the condition of their gonads both Nos. 686 (18 July) and 855 (30 July) also appear to have been either breeding or about to; the largest ovarian follicles of the former measured about 3 mm. in diameter, the testes of the latter 4×3 mm.

The above evidence suggests that while the breeding season is undoubtedly at its height in the months from December to May, it may extend considerably on either side of these extremes. In fact, it seems more than likely that, as is the case in other areas, breeding continues more or less sporadically throughout the rest of the year also.

Bourdillon gives December to June as the breeding season in Travancore, and according to him the birds lay 3 or 4 eggs. My experience during the Surveys has been invariably with 2 eggs or young.

Iole icterica (Strickland). The Yellow-browed Bulbul.

Specimens collected: 32 o? 7-1-33 Marāiyūr (at 4,500 ft.); 208 ♀ 3-2-33 Thattākād 200 ft.; 432 ♂ (juv.) 10-3-33 Camp Derāmalāi 3,000 ft.; 875 ♀? 17-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Santhanpāra (3,500 ft.), Peermade (3,200 ft.), Kūmili (3,000 ft.), Rājampāra (1,350 ft.), Tenmalāi (500 ft.), Balamore Estate (2,000 ft.), Wadakkāncheri (400 ft.), Pādagiri (from 1,500 ft. up).

Colours of bare parts: *Adult*: Iris brownish-red; bill horny-black; mouth brownish-pink, slaty-pinkish and yellow, or pinkish-grey varying apparently with age (or season ?); legs and feet slaty-grey; claws horny-black. *Juvenile* (No. 432): Iris greyish-olive; bill pale horny-brown; naked chin and circumorbital skin dull magenta; gape yellowish-cream; mouth livid pink; legs pinkish-grey; feet pinkish-flesh; claws pale horny-brown.

[Series not satisfactory for measurements owing to moult. I have also examined 6 specimens from Travancore and 4 from the Pālnis in the British Museum Collection.—H. W.]

The Yellow-browed Bulbul is one of the commonest forest-frequenting species in all suitable tracts throughout the two States. Ferguson says it is confined to the hills; I met it from an altitude of about 200 ft. (Thattākād) up to 5,000 ft., but as in the Nilgiris it probably occurs still higher up.

The birds move about in noisy parties of 5 to 7 or more, feeding on the berries of many forest trees, and are frequently met with in the localised bird associations.

In the Pālnis, according to Fairbank (*S.F.*, v, 405), it occurs in small flocks from about 4,000 ft. up. It is generally distributed as a forest bird in Ceylon with no difference of race.

Breeding: Specimens Nos. 32 (7 January) and 208 (3 February) had undeveloped gonads, but on 7 February (Thattākād) a nest was found with one of the owners brooding. It was a flimsy cup of leaf-stalks etc. slung hammock-wise in the horizontal fork of a small twig of *Irul* (*Xylia xylocarpa*) overhanging the old High Range Road, at a height of about 7 ft. The nest contained c/2 (fresh), pinkish-white in ground colour with faint and fine phantom specks of reddish-brown, especially about the broad end. Both the eggs measured 23×16 mm. The parent sat very close for a time when I was under the nest, peering at me over the brim, but finally its courage failed and it departed in haste! Another bird on the same date was observed carrying a caterpillar in its bill to nest young. Inspite of breeding being in progress, most birds continued to remain in feeding parties.

No. 432 (9 March) is a juvenile just out of nest and about a fortnight old. While examining this specimen Mr. Whistler remarks that he cannot help feeling there must have been an error somewhere as it agrees with *Pycnonotus luteolus* in every respect and has no resemblance to *Iole*, whereas by all the rules of the family the young of *Iole* should resemble the adult fairly closely! I can only reply to this by saying that I have 'no possible probable shadow of doubt' that the young is *Iole* and none other. It was being fed and fussed over by the parents when shot. Besides the biotope at Camp Derāmalāi was totally unsuitable for *Pycnonotus luteolus* which was not seen in this locality at all.

In the Nelliampathies where Kinloch describes it as extremely common, he found the usual noisy flocks broken up into pairs in February. He took eggs in that month (*Nidification*, i, 387) though in Travancore Stewart found March and April to be the usual breeding months.

According to the *Fauna* (vol. i, p. 405) the Yellow-browed Bulbul breeds principally in February and March from Kanara to Travancore, and this is confirmed by the data now obtained by the Surveys.

Pycnonotus xantholæmus (Jerdon). The Yellow-throated Bulbul.

Not met with by the Surveys, neither do Hume, Ferguson or any others record it from Travancore nor Kinloch from the Nelliampathy Hills.

Travancore has been included in its 'Distribution' (*Fauna*, i, 415) on the strength of a single specimen obtained by William Davison at 4,020 ft. in the Annemalāi Hills at about 10°N. lat. and 'considerably to the West'. This would mean somewhere in the neighbourhood of Devikolam and about the junction of the High Range and Cardamom Hills sections. According to the collector this was the only example seen by him in two weeks (*Ibis* 1886, p. 146). The bird can therefore have been no more than an aberrant straggler beyond the extreme edge of its range, and in the absence of any further authentic evidence of its occurrence in Travancore, the inclusion of this area in the accepted distribution seems scarcely justified.

Pycnonotus gularis (Gould). The Ruby-throated Bulbul.

Specimens collected: 215 ♂, 216 ♀ 4-2-33 Thattākād 200 ft.; 446 ♂ 16-3-33 Rājampāra 1,350 ft.; 807 ♀ 8-8-33 (Mūkūnnimalāi 800 ft.) Trivandrum Environs; 919 ♂ 29-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Ūrūmbikera Res. Forest near Mūndakāyam (ca. 1,000 ft.), Periyār Lake Environs near Kūmili, Tenmalāi (500 ft.), Balamore Estate (2,000 ft.); Kūvalle Incline (Cochin Forest Tramway); Kūriārkūtti (1,600 ft.); Pādagiri (3,000 ft.).

Colours of bare parts: Iris creamy-white; bill brownish-black; mouth yellowish-pink; legs, feet and claws horny-brown.

[The specimens measure:

	Bill.	Wing.	Tail.
3 ♂♂	15.5-16	74.5-77	68-70 mm.
2 ♀♀	14.5-15	72.5-75	67-68 mm.—H. W.]

The Ruby-throated Bulbul is not as uncommon as Ferguson's remarks (*J.B.N.H.S.*, xv, 264) would lead one to expect. I met it from about 200 ft. elevation up to 3,000 ft. but not higher, and it seems to have a decided preference for the hummocky foothills. Though a bird of evergreen forest in the sense that it is never found away from it, it is really the intermediate zone with a mixture of evergreen and deciduous vegetation—more correctly the edge of evergreen forest where land once cleared for rubber or other cultivation has become covered with secondary growth and tangles of *Mimosa*, *Mezoneuron* and the like—that is most suited to its taste. On the ghat road from Nemmāra to Pādagiri, Ruby-throated Bulbuls appeared as soon as about 1,500 ft. was reached and the requisite type of country commenced.

A specimen obtained by W. Daly on Mount Stewart in the Annemalāi Hills is in the Indian Museum. Fairbank (*S.F.*, v, 405) obtained a single specimen at Vengayam Parry (Pālni Hills) in 1867 but was never able to meet the bird there again, from which one may gather that it is very rare in those hills. It is not found in Ceylon.

In general habits it closely resembles both *Molpastes* and *Otocompsa* but is shyer and more retiring. It has a very pleasant song something of a cross between the song of *Otocompsa* and that of *Leucocirca aureola*. Many of the notes and bars are identically those of the latter but uttered with the richness and volume of the former.

Many species of berries are eaten and the various *Ficus* figs also form an important part of the dietary.

Breeding: In specimen No. 919 (29 November) the testes measured 3×2 mm. In 215 (4 February) they were also 3×2 mm., while in 446 (16 March) they had enlarged to 5×3 mm. and the bird was completing pre-nuptial body moult.

The example (No. 807) procured by Pillai on 8 August had mature ovary, the largest follicle measuring about 4 mm. in diameter, and the bird was probably breeding.

In the absence of more precise data it would appear that the breeding season of this Bulbul is ill-defined. The *Fauna* (vol. i, 416) is silent on the point though a detailed description of the nests and eggs is given. *Nidification* (i, 397) mentions a c/2 taken by Stewart in Travancore Hills on 6 March.

Pycnonotus luteolus luteolus (Lesson). The White-browed Bulbul.

Specimens collected: 594 ♂ 15-4-33, 614 ♂, 615 ♂ (juv.) 18-4-33 Arāmboli 250 ft.; 848 ♂ 13-8-33 (Nettāyam 200 ft.); Trivandrum Environs; 947 ♂ 6-12-33 Nemmāra 300 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.), Kottāyam (ca. S.L.), Wadakkāncheri (400 ft.), Trichūr, Karūpadanna (ca. S.L.), Cranganoor Fort. In the Trivandrum Museum I have seen specimens from Ponmūdi and Arāmboli, and several others without data.

Colours of bare parts: *Adult*: Iris reddish-brown; bill brownish-black; mouth yellowish-pink; legs, feet and claws dark plumbeous or blackish-brown. *Juvenile* (No. 615): Iris hazel brown; bill horny-brown.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
5 ♂♂	18.5-20.5	82-90.5	76-80 mm.

Other specimens examined:

Brit. Mus. Coll.: o? 6-6-77 East base of Pālnis (Fairbank); ♂ 16-11-78 Trivandrum (Bourdillon).

Travancore birds must be put definitely with the Indian race and not the smaller Ceylon race.

Juvenile No. 615 is very similar to the adult but the upper parts and gorget are duller and browner in tint. The first primary is soft and rounded and the tail feathers are softer and more pointed.—H. W.]

Unlike the Yellow-browed Bulbul this species is exclusively an inhabitant of more or less dry open bush-and-scrub country and avoids forest. It is not uncommon, but is confined to the low country in Travancore and Cochin with the only exception of Marāiyūr where it was present in the valley among scrub patches bordering the terraced paddy-fields and in the vicinity of the camp-shed. That it does not ascend the hills in this area of heavy rainfall as it does in the Eastern Ghats ('from sea-level to 4,000 ft.'—*J.B.N.H.S.*, xxxv, 759) is doubtless due to the fact that here the hills are either open and grass-covered or clothed in evergreen jungle and lacking in the dry bush-and-scrub country that forms its habitat.

In the Pālnis also Fairbank (*S.F.*, v, 405) found it common only at the east base of the hills.

In Ceylon this Bulbul is represented by the smaller race *P. l. insulae*.

Breeding: Specimen No. 947 (6 December) showed no genital development. No. 594 (15 April) with testes 6×5 mm. was evidently breeding. In No. 614 (18 April) the testes measured ca. 3×2 mm. and were apparently reverting to the normal non-breeding condition. It was accompanied by No. 615 (with very soft skull) in juvenile plumage and with the rectrices and remiges only partially grown. The birds at Arāmboli between 15 and 22 April were mostly accompanied by young in various stages from which it may be inferred that the breeding season is March and April, possibly beginning earlier—in February—and continuing later as suggested by No. 848 which had an imperfectly ossified skull as late as 13 August.

Microtarsus poiocephalus (Jerdon). The Grey-headed Bulbul.

Specimens collected: 201 ♂ 3-2-33, 230 ♀ 7-2-33, 249 ♂ 9-2-33, 278 ♂ 12-2-33 Thattākād 200 ft.; 429 ♂ 9-3-33 Camp Derāmalāi 3,000 ft.; 476 ♂ 20-3-33 Rājampāra 1,350 ft.; 653 ♂ 24-4-33 Balamore Estate 2,000 ft.

Elsewhere noted at: Ūrūmbikera Res. Forest near Mūndakāyam (1,000 ft.), Tenmalāi (500 ft.), Kūriārkūtti (1,600 ft.), Wadakkāncheri (400 ft.).

I have seen specimens in the Trivandrum Museum from Kūttyāni (Sex ?, 25-5-95) and Ponmūdi (December 1890, and others).

Colours of bare parts: Iris grey; bill greenish-yellow; mouth pink with brownish patches or yellow and pink, perhaps varying according to age (or season ?); legs and feet pale dusky orange-yellow; claws paler.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
6 ♂♂	14.5-17.5	75.5-78.5	70.5-77 mm.
1 ♀	16	75.5	73 mm.

The juvenile of this species appears to be quite unknown and no hint of the plumage stages is afforded by this fine series all of which are in full plumage with no moult other than odd body feathers.—H. W.]

The Grey-headed Bulbul is one of the species confined to the heavy rainfall area of South-West India, the other members of the genus being dwellers of parallel biotope in the Indian Empire and beyond its eastern borders.

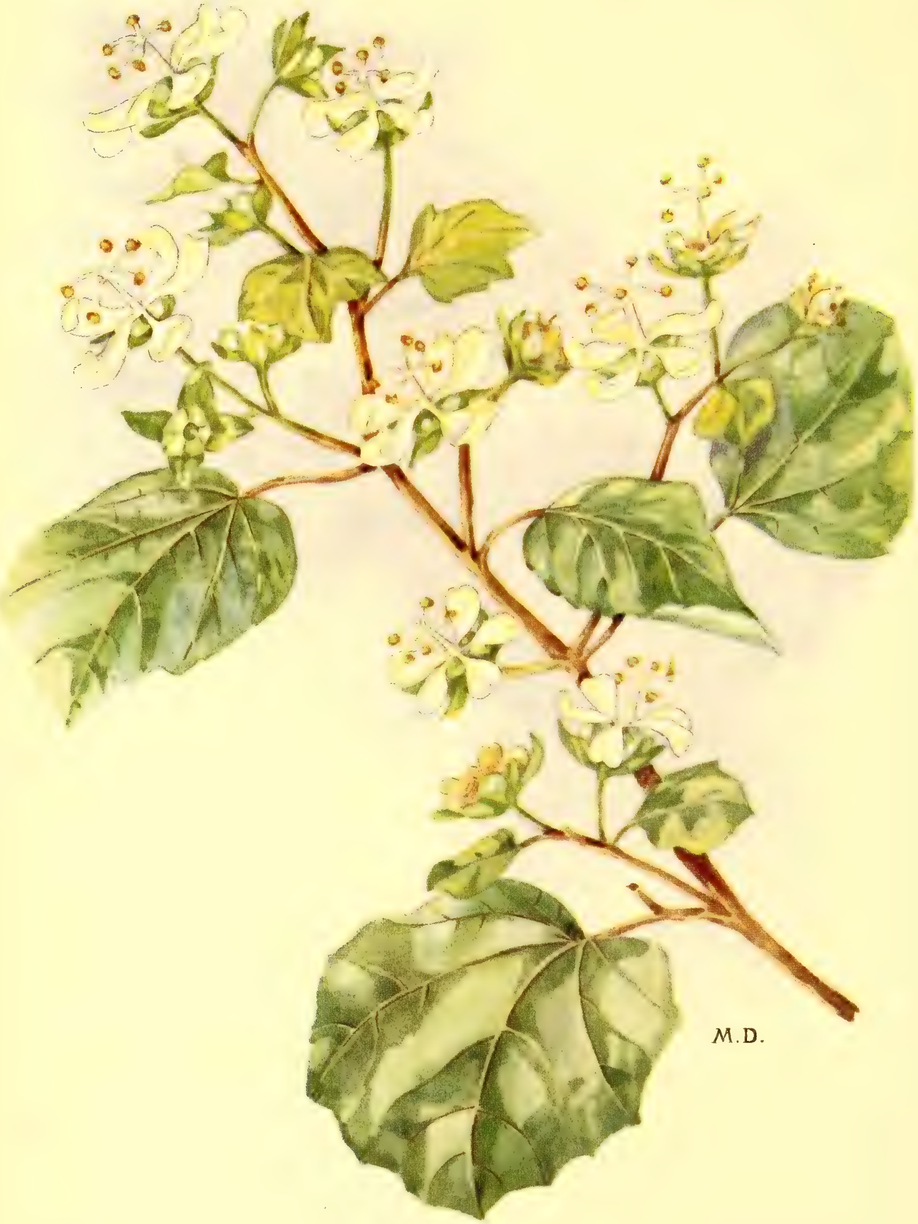
Ferguson mentions that in Travancore he found this bird only on the hills at about 2,000 ft. altitude, but that he shot one at Kūttyāni, an exceptional locality in the low country where the old forest was still standing. This is undoubtedly the specimen now in the Trivandrum Museum. Mr. Pillai who visited Kūttyāni in August 1933 reports that most of the forest has now been cleared and he apparently did not come across this species there. Ferguson's experience shows how very closely knit this form is with evergreen forest, a fact which my experience in Travancore-Cochin fully confirms. The biotope it frequents is very similar to that of *P. gularis* but it usually prefers even more humid facies with denser gowth and often a good deal of rattan (*Calamus*) intermixed.

The only notes I heard this Bulbul utter were a single harsh *chaik, chaik*, frequently followed by a squeaky *cheek* or *pink* (the latter somewhat reminiscent of a finch or *Dendronanthus*—) repeated every second or so. The birds were seen both in pairs and gregariously feeding largely on several kinds of Ficus figs in company with *Iole, Thereiceryx* and other frugivorous species. When dead and in the hand, the bird bears a curious resemblance to a miniature green pigeon! This species is absent in Ceylon.

Breeding: In No. 201 (3 February) the testes measured 3×2 mm. and the bird appeared to be preparing to breed; 230 (7 February) likewise had a distinctly granulated ovary; in both 249 (9 February) and 278 (12 February) the organs were as in 201. Nos. 429 (9 March—testes 4×3 mm.), 476 (20 March—testis (only one !) 6×4 mm.) and 653 (24 April—testis (again only one !) 5×4 mm.), were also ready to breed if not doing so at the time. Indeed in the last there was an incubation patch to justify this presumption. All the specimens were in fresh plumage.

The *Fauna* (i, 426) as well as *Nidification* (vol. i, p. 407) give a description of nests and eggs, invariably c/1, obtained in Travancore by Stewart and Bourdillon. According to the former the breeding season is April and May.

(To be continued).



John Bale Sons & Danielsson L^td London

ROXBURGH'S KYDIA.
Kydia calycina Roxb.
(about 2/3 nat. size).

SOME BEAUTIFUL INDIAN TREES.

BY

The late E. Blatter, s.j., ph.d., f.l.s.,
and W. S. Millard, f.z.s.

Part XVIII.

(*With one coloured plate and two text-figures*).

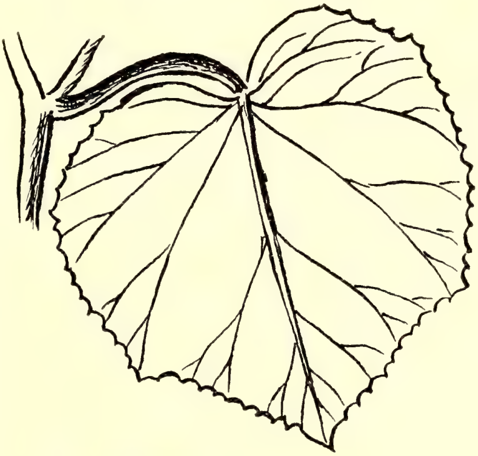
(*Continued from page* 750 *of volume* xxxvii).

Plate XXVI.—Roxburgh's Kydia.

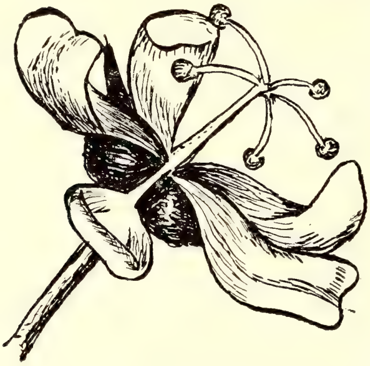
Popular Names: Pula, Puli, Patha (Hind.); Bargah, Baranga (C.P.); Kopasia (Uriya); Warung, Iliya (Mar.); Bellaka, Bendi (Kan.); Potri, Kandiki (Tel.); Tabo, Dwalok, Myethlwa (Burm.).

Kydia calycina Roxb. Hort. Beng. (1814), p. 51. Belongs to the family *Malvaceae*. The genus is named after Colonel Robert Kyd, founder and first Director of the Royal Botanic Gardens, Calcutta, who died in 1794. The specific name is with reference to the prominent calyx.

Description: A large shrub or small tree. Leaves 3-6 in. long, fanwisely 7-nerved, heart-shaped at the base, usually 3-7 lobed; lobes often angular, the median one the largest, smooth above, densely close haired beneath; leaf-stalk 1-2 in. long. Panicles many flowered, covered with tawny short hairs, flower-stalk $\frac{3}{8}$ in. long. Below the calyx there is a series of 4-6 strongly nerved involucral bracts which enlarge and persist in fruit, $\frac{1}{4}$-$\frac{3}{8}$ in. long. Corolla white or pink, petals reversedly heart-shaped, longer than the calyx, prolonged into a claw at the base with a tuft of hairs on either side. The filaments are united to form a staminal tube for a little more than half their length then dividing into 5 spreading branches, each carrying 3 almost stalkless anthers. Style branches 3, each surmounted by a large disc-like stigma. Fruit 3-valved, about the size of a pea, covered with mealy dust, rounded with a slightly umbrella-shaped top. Seeds kidney-shaped, striated, brown-black.



Distribution: Common throughout India and Burma chiefly in mixed and deciduous forests not in arid regions.



Gardening: Propagated from seed. The seeds possess a comparatively low germinating power but this is compensated by the large number produced. The seeds should be sown in seed beds, and the seedlings transplanted when they are 2-3 in. high. The rate of growth is rapid and it has been estimated that the tree reaches its maximum growth at a comparatively early age, though the exact age has not been ascertained (Troup).

The leaves commence to fall at the end of November and the plant is leafless from January or early February to late April. The flowers appear in September-October, and the masses of greenish white or pale lilac blossoms make the tree a conspicuous sight at this season (Troup).

Uses: The inner bark yields a bast fibre used for coarse ropes etc. The fibre has a high resisting power to decomposition by moisture.

(*To be continued*).

A LIST OF THE BIRDS OF THE CENTRAL PROVINCES.

BY

E. A. D'ABREU, F.Z.S.

(*Curator, Central Museum, Nagpur*).

The following is a brief list of the birds of the Central Provinces which I have collected, observed, or I am otherwise aware of during a residence of over twenty years. Species which are probably to be found but which I have not yet observed or identified with certainty are enclosed in brackets. Every part of the Provinces has not been visited by me and most of the observations have been made at Nagpur, or in the districts during the winter months. In 1923 I published a list of the Central Provinces Birds in Record No. III of the Nagpur Museum. This list is now out of date as many alterations and additions have become necessary.

ORDER: PASSERES.

1. [**Corvus corax laurencei** (Hume). The Punjab Raven.
A rare straggler in Berar.]

2. **Corvus macrorhynchos culminatus** Sykes. The Indian Jungle-Crow.
Resident, breeds February to April.

3. **Corvus splendens splendens** (Vieill.). The Indian House-Crow.
Resident. Breeds in June and July. An albino was secured at Kodamendhi, Nagpur District, by Mr. P. G. H. Stent, I.C.S.

4. **Dendrocitta v. vagabunda** (Lath.). The Bengal Tree-Pie.
Resident. It is probably a local migrant; at Nagpur, they are not seen till September and they disappear again when the weather gets warm.

5. [**Dendrocitta leucogastra** (Gould). The Southern Tree-Pie.
McMaster records a specimen from Chikalda.]

6. **Parus major mahrattarum** Hartert. The Southern Grey-Tit.
Resident in elevated and well-wooded parts of the Provinces. Not as common as the next species.

7. **Machlolophus xanthogenys aplonotus** (Blyth). The Central India Yellow-cheeked Tit.
Resident and common in well-wooded tracts.

8. **Sitta castanea castanea** Less. The Chestnut-bellied Nuthatch.
Breeds April to May (Pachmarhi).

9. **Sitta castanea prateri** Whist. Prater's Nuthatch.
A specimen obtained at Damarincha, Ahiri State.

10. **Sitta frontalis frontalis** (Horsf.). The Velvet-fronted Blue Nuthatch.
Has been observed at Saugor and Betul.

11. **Turdoides terricolor terricolor** (Hodg.). The Bengal Jungle Babbler.
A very common resident. Breeds chiefly from June to July.

12. **Turdoides striatus polioplocamus** Ob. The White-headed Babbler.
Resident in South Chanda.

13. **Argya caudata caudata** (Dum.). The Common Babbler.
A common resident.

14. **Argya malcolmi** (Sykes). The Large Grey Babbler.
A common resident.

15. **Pomatorhinus horsfieldi obscurus** (Hume). Hume's Scimitar-Babbler.
Most probably a resident in the Satpura Plateau; specimens recorded from Seoni, Dhupgarh near Pachmarhi (Osmaston) and Balaghat (Baihar Tahsil). Whether the birds seen by me in the Balaghat District were this or the subspecies *P. n. horsfieldi*, the Deccan Scimitar-Babbler, I am unable to tell, as the birds were not secured.

16. **Dumetia hyperythra** (Franklin). The Rufous-bellied Babbler.
A common resident throughout the well-wooded parts. Breeds late, June to September.

17. **Chrysomma sinensis sinensis** (Gm.). The Indian Yellow-eyed Babbler.
Resident throughout the Provinces. Breeds June to September. Clutches, even from the same locality, appear to belong to two distinct types. In one the eggs are smaller and speckled with red resembling eggs of *D. hyperythra;* in the other the eggs are larger and heavily blotched and streaked with red.

18. **Pellorneum ruficeps ruficeps** (Swain). The Indian Spotted Babbler.
Fairly common at Pachmarhi where it breeds May to June (Osmaston).

19. **Mixornis gularis rubricapilla** (Tick.). The Yellow-breasted Babbler.
Three specimens of this bird were obtained by me at Parasgaon in the Bastar State.

20. **Alcippe poioicephala brucei** (Hume). The Bombay Quaker-Babbler.
I obtained a specimen in the Bastar State and found it common in the Baihar Tahsil of the Balaghat District. It is not uncommon at Pachmarhi where it breeds early in July.

21. **Aegithina tiphia humei** S. B. The Central Indian Iora.
A common resident. Breeds June to July.

22. [**Aegithina nigrolutea** (Marsh.). Marshall's Iora.
Occasionally found in the Northern parts of the Provinces.]

23. **Chloropsis aurifrons davidsoni** (Bak.). The Malabar Chloropsis.
Mr. Master records this species from Chikalda in Berar and I found it on the banks of the Indravati in the Ahiri State.

24. **Chloropsis jerdoni** (Blyth). Jerdon's Chloropsis.
Resident throughout the Provinces. Breeds June to July.

25. [**Hypsipetes psaroides ganeesa** (Sykes). The Southern Indian Black Bulbul.
McMaster procured this bird at Chikalda on the Gawilgarh hills in Berar.]

26. **Molpastes cafer cafer** Linn. The Madras Red-vented Bulbul.
Common resident. Breeds May to August.

The Bulbuls of the Jubbulpore District are intermediate between the Central Indian Bulbul (*M. c. pallidus*) and the Bengal Bulbul (*M. c. benghalensis*). They are larger birds with a wing measurement of about 100 mm. The Bulbuls from the south-eastern parts of the Provinces will probably turn out to be *M. c. saturatus*, K. & W. but specimens have not yet been examined.

27. [**Molpastes leucogenys leucotis** (Gould). The White-eared Bulbul.
Found north of the Nerbudda extending east to Hoshangabad and Saugor. I have not observed this bird personally.]

28. **Otocompsa jocosa emeria** (Linn.). The Bengal Red-whiskered Bulbul.
I secured one of a pair at Nagpur on the 7th April 1932.

29. **Otocompsa jocosa fuscicaudata** (Gould). The Southern Red-whiskered Bulbul.

This Bulbul is found in the Melghat and I have observed it in the Balaghat and Chhindwara Districts and also at Pachmarhi, where it breeds from April to July but the birds from the three latter localities have not been examined.

30. **Otocompsa flaviventris flaviventris** (Tick.). The Black-crested Yellow Bulbul.
Resident at Pachmarhi, where it breeds in June.

31. **Pycnonotus luteolus** (Less.). The White-browed Bulbul.
Resident at Nagpur and Kamptee, but not plentiful. Breeds in June. This bird shuns observation though its call is familiar.

32. **Salpornis spilonotus** (Frankl.). The Spotted Grey Tree-Creeper.
A rare resident. I got a specimen at Nagpur, another in the Chanda forests, and a third in the Betul District.

33. **Saxicola caprata bicolor** (Sykes). The Northern India Pied Bush-Chat.
A winter visitor to the Provinces.

34. **Saxicola caprata burmanica** S. B. Indo-Burmese Pied Bush-Chat.
Resident. Breeds in April and May.

35. **Saxicola torquata indica** (Blyth). The Indian Bush-Chat.
A common winter visitor.

36. [**Œnanthe opistholeuca** (Strick.). Strickland's Chat.
A winter visitor as far south as Nagpur according to Oates.]

37. **Cercomela fusca** (Blyth). The Brown Rock-Chat.
Resident in the Jubbulpore, Saugor, Damoh and Hoshangabad Districts, but probably has a wider range. Breeds March to July in holes of walls, quarries, cliffs, etc.

38. **Phoenicurus ochrurus phoenicuroides** (Vieill.). The Black Redstart.
A common winter visitor. It appears at Nagpur on or about the 23rd September.

39. **Cyanosylvia suecica** (L.). The Blue-throat.
A common winter visitor.

40. **Calliope calliope** (Pall.). The Common Ruby-throat.
A rare winter visitor. A specimen was secured at Lamta in the Balaghat District.

41. **Saxicoloides fulicata cambaiensis** (Lath.). The Brown-backed Indian Robin.
A common resident north of the Taptee River.

42. **Saxicoloides fulicata intermedia** Whistler and Kinnear.
Resident south of the Taptee River.

43. **Copsychus saularis saularis** (Linn.). The Indian Magpie-Robin.
A very common resident. Breeds May to July.

44. **Kittacincia malabarica malabarica** Scop. The Shama.
Has been recorded from Raipur.

45. **Turdus simillimus mahrattensis** Whist. The Black-capped Black-bird.
Rare, but may possibly breed in the Provinces. It has been recorded at Chikalda and I got specimens at Khawasa in the Seoni District and one at Nagpur.

46. [**Turdus unicolor** Tick. Tickell's Thrush.
A winter visitor, has been taken at Raipur.]

47. **Geokichla citrina citrina** (Lath.). The Orange-headed Ground-Thrush.
Probably found sparingly in the Provinces during the winter only. There is a specimen from Raipur in the British Museum.

48. **Geokichla citrina cyanotis** (Jard. & Sel.). The White-throated Ground Thrush.
Resident in the well-wooded tracts. Breeds June to July.

49. **Monticola cinclorhyncha** (Vig.). The Blue-headed Rock Thrush.
A winter visitor, a few specimens have been obtained at Nagpur.

50. **Monticola solitaria pandoo** Sykes. The Blue Rock-Thrush.
A winter visitor to the whole of the Provinces.

51. **Myiophonus horsfieldi** (Vigors). The Malabar Whistling-Thrush.
Resident in parts of the Provinces; very common at Pachmarhi and the Melghat and also recorded in the Sirguja State. Breeds June to July, placing its nest in crevices in more or less vertical rocks in ravines.

52. **Siphia parva parva** (Bechst.). The European Red-breasted Flycatcher.
A common winter visitor.

53. **Muscicapula superciliaris superciliaris** (Jerd.). The White-browed Blue Flycatcher.
A winter visitor has been taken in the Nagpur, Chanda, Balaghat and Chhindwara Districts.

54. **Muscicapula tickelliae tickelliae** (Blyth). Tickell's Blue Flycatcher.
A common resident. Breeds in May and June.

55. **Eumyias thalassina thalassina** (Swain). The Verditer Flycatcher.
A winter visitor.

56. **Alseonax latirostris** (Raff.). The Brown Flycatcher.
Resident.

56A. **Alseonax ruficaudatus.** Rufous-tailed Flycatcher.
A specimen secured by me at Nagpur on 30th October 1934.

57. **Calicicapa c. ceylonensis** (Swain). The Grey-headed Flycatcher.
Common in winter. Recorded breeding at Pachmarhi in June and July.

58. **Tchitrea paradisi paradisi** (L.). The Indian Paradise Flycatcher.
Resident. Breeds June to July.

59. **Hypothymis azurea styani** Hartl. The Indian Black-naped Flycatcher.
Resident, but keeps to well-wooded tracts. Breeds June to August.

60. **Leucocera aureola aureola** (Less.). The White-browed Flycatcher.
This race has been taken in the winter only at Nagpur and may be the resident bird in the north of the Province. It sometimes attends cattle, snapping up the insects disturbed by the animals.

(a) **Leucocerca aureola compressirostris** Blyth. The Southern White-browed Fantail Flycatcher.
This is the breeding bird at Nagpur.

61. **Leucocerca pectoralis** (Jerd.). The White-spotted Fantail Flycatcher.
Resident probably throughout the Provinces. Very common in the Districts of Nagpur, Balaghat and Chanda. Breeds March to July.

62. **Lanius excubitor lahtora** (Sykes). The Indian Grey Shrike.
Resident. Breeds March to May.

63. **Lanius vittatus** (Val.). The Bay-backed Shrike.
One of the commonest shrikes in the Provinces. Breeds June to July.

64. **Lanius nasutus nigriceps** (Frank.). The Southern Black-headed Shrike.
No records of its breeding in the Province, but birds have been secured in the winter months from Bastar, Bilaspur and Nagpur.

65. **Lanius schach erythronotus** (Vig.). The Rufous-backed Shrike.
A winter visitor recorded as far south as Parasgaon in the Bastar State. Has been taken at Nagpur on 18th April 1920. They breed in the northern districts.

66. **Lanius schach caniceps** Blyth. Southern Grey-backed Shrike.
Resident. Breeds chiefly in June.

67. **Lanius schach tephronotus** Vig. The Central Himalayan Grey-backed Shrike.
A straggler into the Provinces in winter. I took a specimen at Ahiri in the Chanda District.

68. **Lanius cristatus cristatus** (L.). The Brown Shrike.
A winter visitor throughout the Provinces. Arriving at Nagpur on September 4th and staying till April 30th.

69. **Hemipus picatus picatus** (Sykes). The Black-backed Pied-Shrike.
Resident in the Satpura Plateau Districts according to Moss-King.

70. **Tephrodornis p. pondicerianus** (Gmel.). The Common Wood-Shrike.
Resident and common throughout the Provinces.

71. **Pericrocotus speciosus semiruber** Whist. The Southern Scarlet Minivet. Not common. I have observed it in the districts of Balaghat, Chhindwara, Betul and the Bastar State. It has also been observed at Pachmarhi. Keeps to well-wooded localities. A party when disturbed were noticed making for trees with red leaves.

72. [**Pericrocotus brevirostris brevirostris** Vig. The Indian Short-billed Minivet. A rare winter visitor.]

73. **Pericrocotus roseus roseus** (Vieill.). The Rosy Minivet. Three specimens were obtained at Nagpur.

74. **Pericrocotus peregrinus perigrinus** (L.). The Small Minivet. A common resident. Breeds February to July.

75. **Pericrocotus erythropygius** (Jerd.). The White-bellied Minivet. Resident, but not common. Breeds in July and August.

76. **Lalage melanoschista melanoschista** (Hodg.). The Dark-grey Cuckoo-Shrike. I have taken this bird in the Bastar State only.

77. **Lalage sykesi** (Strick.). The Black-headed Cuckoo-Shrike. Resident. Breeds May to July.

78. **Graucalus javensis maceii** (Less.). The Large Cuckoo-Shrike. A common resident. Breeds April to June.

79. **Dicrurus macrocercus peninsularis** Ticehurst. The Southern Black Drongo. Common resident. Breeding May to July. Both the spotted and unspotted varieties of eggs have been observed.

80. **Dicrurus leucophaeus longicaudatus** (Hay). The Indian Ashy Drongo. Taken at Nagpur from February to April.

81. **Dicrurus c. caerulescens** (Linn.). The White-bellied Drongo. Resident, but probably a local migrant. Keeps to well-wooded localities and only seen at Nagpur during the cold months (date of arrival is 22nd September). Recorded breeding at Pachmarhi from March to April.

82. [**Chaptia aenea malayensis** (Hay). The Southern Bronzed Drongo. Jerdon has recorded this bird from the Bastar State, but it has not again been observed by others.]

83. **Chibia hottentotta hottentotta** (L.). The Indian Hair-crested Drongo. Probably resident, has been observed at Raipur and Balaghat and taken at Nagpur.

84. **Dissemurus paradiseus grandis** (Gould). The Assam Racket-tailed Drongo. Resident, but keeping to well-wooded parts. Breeds chiefly in May and June.

85. **Dissemurus paradiseus malabaricus** Lath. The Malabar Large Racket-tailed Drongo.
This is the form found at Nagpur and the Bhandara Districts.

86. [**Locustella naevla straminea** (Severty). The Turkestan Grass-hopper Warbler.
Possibly a winter visitor, not observed by me.]

87. **Acrocephalus stentoreus brunnescens** (Jerd.). The Indian Great Reed-Warbler.
A common winter visitor, some birds having been observed on 23rd April at Nagpur. It may possibly breed in the Provinces.

88. **Acrocephalus dumetorum** (Blyth). Blyth's Reed-Warbler. A common winter visitor, taken in Nagpur as early as 4th October.

89. [**Acrocephalus agricola agricola** (Jerd.). The Paddy-field Reed-Warbler. A winter visitor.]

90. **Orthotomus sutorius guzurata** Lath. The Indian Tailor-bird. A common resident. Clutches taken in June and July, but probably breeds both earlier and later.

91. **Cisticola exilis erythrocephala** Blyth. The Red-headed Fantail-Warbler.
Recorded from Saugor and a specimen was secured by me at Khapa in the Balaghat District.

92. **Cisticola juncidis cursitans** (Frankl.). The Streaked Fantail-Warbler.
Resident throughout the Provinces. Breeds August to October.

93. **Franklinia gracilis** (Frankl.). Franklin's Wren-Warbler.
Resident. Breeds during the rains.

94. **Franklinia buchanani** (Blyth). The Rufous-fronted Wren-Warbler.
A specimen was obtained in June at Nagpur and recorded breeding at Saugor.

95. **Megalurus palustris** (Horsf.). The Striated Marsh-Warbler.
Resident in parts of the Provinces, e.g., Hoshangabad and Seoni. Breeds in April.

96. **Chaetornis striatus** Jerd. The Bristled Grass-Warbler.
Resident. Has been recorded from Seoni, Saugor, Raipur and observed breeding at Kamptee in September.

97. **Hypolais rama rama** (Sykes). Sykes' Tree-Warbler.
A common winter visitor, arriving early in September.

98. **Hypolais rama scita** (Eversmann). The Booted Tree-Warbler.
A winter visitor.

99. **Sylvia hortensis jerdoni** Blyth. The Eastern Orphean-Warbler.
A winter visitor. Specimens have been observed or taken in Chanda, Nagpur and in the Melghat.

100. **Sylvia curruca affinis** (Blyth). The Indian Lesser White-throated Warbler.
Very common at Nagpur in the winter.

101. **Phylloscopus collybita tristis** (Blyth). The Brown Willow-Warbler.
A winter visitor. Has been taken at Chhindwara.

102. **Phylloscopus griseolus** Blyth. The Olivaceous Willow-Warbler.
A common winter visitor. It has been observed in the districts of Nagpur, Balaghat, Chanda, Bastar and also at Pachmarhi. It frequently creeps about branches and tree trunks after the fashion of a nuthatch.

103. **Phylloscopus inornatus humei** Brooks. Hume's Willow-Warbler.
A winter visitor. Has been obtained at Nagpur, Bhandara and Mandla.

104. [**Phylloscopus nitidus nitidus** (Blyth). The Green Willow-Warbler.
A winter visitor. Not yet secured.]

105. **Phylloscopus nitidus viridanus** (Blyth). The Greenish Willow-Warbler.
Very common throughout the winter.

106. **Phylloscopus magnirostris** (Blyth). The Large-billed Willow-Warbler.
A winter visitor. Has been taken at Nagpur.

107. [**Phylloscopus occipitalis occipitalis** (Blyth). The Large-crowned Willow-Warbler.
A winter visitor.]

108. [**Seicercus burkii** (Burton). The Black-browed Flycatcher-Warbler.
McMaster records this species from Kamptee and Chikalda.]

109. **Prinia socialis** (Sykes). The Ashy Wren-Warbler.
A common resident.

110. **Prinia sylvatica sylvatica** (Jerd.). The Jungle Wren-Warbler.
Resident. Breeds June to September.

111. **Prinia inornata inornata** (Sykes). The Indian Wren-Warbler.
A common resident. Breeds from August to October, if not throughout the rains.

112. [**Cephalopyrus flammiceps** (Burton). The Fire-capped Tit-Warbler.
A winter visitor, specimens have been taken at Raipur, Saugor and Nagpur.]

113. **Oriolus oriolus kundoo** (Sykes). The Indian Oriole.
A common resident. Breeds May to July.

114. **Oriolus xanthornus maderaspatanus** Franklin. The Indian Black-headed Oriole.
Resident, but more in evidence in well-wooded localities. Breeds May to July.

115. **Gracula religiosa intermedia** (Hay). The Indian Grackle.
Resident in the Bastar State. Breeds from March to May.

116. **Pastor roseus** (L.). The Rose-coloured Starling.
Visits the Provinces in large numbers in the cold weather.

117. **Sturnus vulgaris poltaratskii** (Finsch.). The Indian or Finsch's Starling.
A winter visitor to the Northern districts.

118. **Sturnia malabarica malabarica** (Gm.). The Grey-headed Myna.
Taken in the Bastar State and also observed at Nagpur.

119. **Temenuchus pagodarum** (Gm.). The Black-headed Myna.
A common resident. Breeds from May to August in holes in trees.

120. **Acridotheres t. tristis** (L.). The Common Myna.
Resident, and very common everywhere. Breeds April to July.

121. **Acridotheres ginginianus** (Lath.). The Bank Myna.
Resident in the Nerbudda Valley and in the eastern portions of the Provinces. I found it common in the Kanker State and it extends west to Ramtek and Kamptee. Breeds in June excavating a nest chamber in the vertical banks of rivers or in the sides of wells.

122. **Sturnopastor contra** (L.). The Pied Myna.
Resident throughout the Provinces, but more common to the east and probably absent in the west. Breeds May to July, constructing a massive nest on the branch of a tree.

123. **Ploceus philippinus** (L.). The Baya.
Resident in the open country.

124. [**Ploceus benghalensis** (L.). The Black-throated Weaver-Bird.
Probably resident in the Northern districts. Breeds in the rains.]

125. **Munia malacca** (L.). The Black-headed Munia.
Observed at Pachmarhi by Bates and observed breeding in the east of Bhandara District by F. R. Blewitt on the 19th July.

126. [**Munia atricapilla** (Vieill.). The Chestnut-bellied Munia.
May be resident in the Eastern districts. Breeding June to September in swampy localities.].

127. **Uroloncha striata striata** (L.). The White-backed Munia.
Resident. Very common in the Chanda District, extending north to Bhandara and Betul. Breeds probably throughout the year.

128. **Uroloncha malabarica** (L.). The White-throated Munia.
Common. Breeds February to October.

129. **Uroloncha punctulata lineoventer** Hodg. The Spotted Munia.
Resident. Breeds almost throughout the year.

130. **Stictospiza formosa** (Lath.). The Green Munia.
Resident, observed at Nagpur and at Bhanpuri, Bastar State.

131. **Amandava amandava** (L.). The Indian Red Munia.
Resident. Breeds probably twice in the year. Nests have been taken in September, October and December.

132. **Carpodacus erythrinus** (Pall.). The Common Rose-Finch.
A winter visitor.

133. **Gymnorhis xanthocollis xanthocollis** (Burton). The Yellow-throated Sparrow.
A common resident. Breeds from April to May in holes in trees,

134. **Passer domesticus indicus** J. & S. The Indian House-Sparrow.
This is the form which is resident at Nagpur.

135. **Emberiza stewarti** (Blyth). The White-capped Bunting.
A specimen was obtained at Nagpur in December.

136. **Emberiza buchanani** (Blyth). The Grey-necked Bunting.
A winter visitor.

137 **Emberiza melanocephala** (Scop). The Black-headed Bunting.
A winter visitor.

138. **Emberiza icterica** Evers. The Red-headed Bunting.
A common winter visitor.

139. **Melophus lathami subcristata** (Sykes). The Crested Bunting.
Resident. Breeds April to August, making a saucer-like nest of grass on the ground or in holes of banks and walls.

140. **Delichon urbica cashmeriensis** (Gould). The Kashmir Martin.
A solitary specimen was obtained by Blanford at Bilaspur in April.

141. **Riparia paludicola brevicaudata** Horsf. The Indian Sand-Martin.
Resident. Keeping to the banks of the larger streams. Breeds November to February in the sandy banks of rivers, constructing a scanty nest at the end of a narrow tunnel about three feet in length.

142. **Krimnochelidon concolor** (Sykes). The Dusky Crag-Martin.
Resident.

143. **Hirundo rustica rustica** (L.). The Common Swallow.
A winter visitor.

144. **Hirundo smithii filifera** Stephens. The Wire-tailed Swallow.
Breeds probably throughout the year.

145. **Hirundo fluvicola** (Jerd.). The Indian Cliff-Swallow.
Resident.

146. **Hirundo daurica nepalensis** (Hodg.). Hodgson's Striated Swallow.
A winter visitor.

147. **Hirundo daurica erythropygia** (Sykes). Sykes' Striated Swallow.
Resident.

148. **Motacilla alba dukhunensis** (Sykes). The Indian White Wagtail.
A common winter visitor.

149. **Motacilla alba personata** (Gould). The Masked Wagtail.
A winter visitor.

150. **Motacilla maderaspatensis** (Gmel.). The Large Pied Wagtail.
Resident.

151. **Motacilla cinerea caspica** Gm. The Eastern Grey Wagtail.
A winter visitor. Arrives at Nagpur on about 20th September.

152. **Motacilla flava thunbergi** (Billberg). The Grey-headed Wagtail.
A winter visitor.

153. **Motacilla flava beema** (Sykes). The Indian Blue-headed Wagtail.
A winter visitor.

154. **Motacilla feldegg feldegg** Mich. The Black-headed Wagtail.
A winter visitor taken at Nagpur.

155. **Motacilla citreola werae** Buturlin. The Yellow-headed Wagtail.
A winter visitor.

156. [**Dendronothus indicus** (Gmel.). The Forest Wagtail.
A rare winter visitor, not yet observed.]

157. **Anthus trivialis haringtoni** With. Witherby's Tree Pipit.
A winter visitor. I have definite records from Melghat and Pachmarhi.

158. **Anthus t. trivialis** L. The Indian Tree-Pipit
A common winter visitor.

159. [**Anthus leucophrys jerdoni** (Finsch.). The Brown Rock-Pipit.
A winter visitor.]

160. [**Anthus richardi richardi** (Vieill.). Richard's Pipit.
A specimen was obtained at Nagpur.]

161. [**Anthus richardi thermophilus,** Jerd. Blyth's Pipit.
A winter visitor.]

162. **Anthus rufulus** (Vieill.). The Indian Pipit.
A common resident.

163. **Anthus campertris griseus** (Blasius). The Eastern Tawny Pipit.
A winter visitor. Taken at Nagpur, Jubbulpore and the Kankar State.

164. **Alauda gulgula gulgula** (Frank.). The Small Indian Sky Lark.
Resident.

165. **Calandrella brachydactyla dukhunensis** (Sykes). The Rufous Short-toed Lark.
A winter visitor. Found in large flocks. These larks are the so-called Ortolans.

166. **Alaudula raytal raytal** (Blyth). The Ganges Sand-Lark.
Resident. Has been observed breeding in the Saugor and Damoh Districts and in the Nerbudda and Kanhan beds in May.

167. **Mirafra javanica cantillans** (Jerd.). The Singing Bush Lark.
Resident. Breeds in April and again from August to September.

168. [**Mirafra assamica assamica** (McC.). The Bengal Bush-Lark.
Recorded by Murray as resident in the Eastern parts of the Central Provinces.]

169. **Mirafra erythroptera** (Jerd.). The Red-winged Bush-Lark.
Breeds in April and again from July to September.

170. **Galerita cristata chendoola** (Frank.). The Crested Lark.
Resident in the Northern districts where it breeds from April to May.

171. **Galerita deva** (Sykes). Sykes' Crested Lark.
Resident. Breeds May to June.

172. **Ammomanes phoenicura phoenicura** (Frank.). The Rufous-tailed Finch-Lark.
Resident.

173. **Eremopterix grisea** (Scop). The Ashy-crowned Finch-Lark.
Resident. Breeds December to May and again in August and September.

174. **Zosterops palpebrosa occidentis** Ticeh. The North-western White-eye.
Resident.

175. **Aethopyga siparaja seheriae** (Tick.). The Himalayan Yellow-backed Sun-bird.
I shot a male of this species at Lougher in the Balaghat District on the 1st April at an altitude of about 2,000 ft.

176. **Cinnyris asiatica asiatica** (Lath.). The Purple Sun-bird.
A common resident.

177. **Cinnyris zeylonicus** (L.). The Purple-rumped Sun-bird.
A common resident in the eastern parts of the Provinces, Raipur, Bastar, etc., extending west to the Bhandara District, and even to Nagpur where it is scarce.

178. [**Dicaeum concolor subflavum** S. B. The Belgaum Flower-picker.
May be found in the western parts of the Central Provinces.]

179. **Dicaeum e. erythrhynchos** (Lath.). Tickell's Flower-pecker.
Resident.

180. **Piprisoma agile agile** Tick. The Thick-billed Flower-pecker.
Resident. Breeds February to May.

181. **Pitta brachyura** (Linn.). The Indian Pitta.
Resident. Breeds in June and July, constructing a huge globular nest of twigs and leaves on the ground or on low branches.

ORDER: CORACIFORMES.

182. **Picus xanthopygius.** Gray. The Little Scaly-bellied Green Wood-pecker.
Found sparingly in the Bastar State and in the Balaghat District. It is probably resident.

183. **Dryobates m. mahrattensis** (Lath.). The Yellow-fronted Pied Wood-pecker.
A common resident. Breeds February to April.

184. **Dryobates h. hardwickii** (Jerdon). The Southern Pigmy Wood-pecker.
Resident. Common in well-wooded parts. Breeds March to April.

185. **Micropternus brachyurus phaioceps** Blyth. The Orissa Rufous Wood-pecker.
I saw and took specimens of this bird at Khapa in the Balaghat District. Breeds in April and May, constructing its nest within the nest of the black tree ant (*Plagiolepis*).

186. **Brachypternus benghalensis benghalensis** (L.). The Northern Golden-backed Wood-pecker.
A common resident. Breeds January to March. This is the race found at Nagpur and Betul.

187. **Brachypternus benghalensis puncticollis.** Malherbe's Southern Golden-backed Wood-pecker.
This form has been taken in the Chanda and Bhandara Districts, intermediates between the two forms also occur in the latter district.

188. **Chrysocolaptes festivus** (Bodd.). The Black-backed Wood-pecker.
I have taken this bird at Charama in the Kanker State, at Tamia in the Chhindwara District and in the Betul District. It is probably a resident breeding during the cold months and laying a single white egg in a hole in a tree as usual.

189. [**Hemicercus canente cordatus** Jerd. The Heart-spotted Wood-pecker.
Jerdon reported the occurrence of this bird in the Chanda forests, but it has not been observed by anybody since.]

190. **Iynx torquilla** L. The Wryneck.
A winter visitor.

191. **Thereiceryx zeylanicus caniceps** (Frank.). The Northern Green Barbet.
Common in well-wooded localities. Breeds April to May.

192. **Xantholaema haemacephala indica** Lath. The Indian Crimson-breasted Barbet.
Common. Breeds from January to April, earlier in the south.

193. **Cuculus canorus telephonus** (Heine). The Asiatic Cuckoo.
I have regularly observed and heard cuckoos in the Nagpur, Bhandara, Bilaspur and Chanda Districts from April to June the earliest date being the 27th April.

194. **Cuculus poliocephalus poliocephalus** (Lath.). The Small Cuckoo.
A single female specimen was taken at Nagpur on 15th September 1913.

195. **Cuculus micropterus micropterus** (Gould). The Indian Cuckoo.
I have taken this bird at Nagpur in May, observed at Chanda (6th April) and at Beemalgondee, Chhindwara District (12th May).

196. [**Hierococcyx sparverioides** (Vig.). The Large Hawk-Cuckoo.
Has been recorded as a straggler at Raipur.]

197. **Hierococcyx varius** (Vahl.). The Common Hawk-Cuckoo or Brain-fever Bird.
A common resident, depositing its eggs in the nests of Babblers.

198. **Cacomantis merulinus passerinus** (Vahl.). The Indian Plaintive Cuckoo.
Resident. The eggs have been taken from the nests of Franklin's Wren Warbler. Two males of *C. m. querulus* were obtained by Hume at Raipur in 1871.

199. [**Penthoceryx sonneratii sonneratii** (Lath.). The Banded Bay Cuckoo.
A rare species, recorded from Raipur.]

200. **Clamator jacobinus pica** Hempr. & Ehr. The Pied Crested Cuckoo.
Arrives with the breaking of the monsoons and after depositing eggs in the nests of Babblers disappears before the cold weather sets in.

201. **Eudynamis scolopaceus scolopaceus** (L.). The Indian Koel.
Lays from April to June from 1 to 3 eggs in the nests of crows and once in that of *Oriolus kundoo.*

202. **Rhopodytes viridirostris** (Jerd.). The Small Green-billed Malkoha.
Recorded from Sironcha.

203. **Taccocua leschenaulti sirkee** Gray. The Southern Sirkeer Cuckoo.
Resident.

204. **Centropus sinensis parroti** (Stres.). The Southern Crow-Pheasant.
Breeds June to August, making a huge globular nest of sticks, green leaves and grass in a thorny bush or tree.

205. **Psittacula eupatria nipalensis** (Hodg.). The Large Indian Paroquet.
Common in well-wooded localities. Breeds March to April in holes in trees.

206. **Psittacula krameri manillensis** Bechst. The Rose-ringed Paroquet.
Common. Breeds February to May. Some birds have the lower mandibles red.

207. **Psittacula cyanocephala cyanocephala** (L.). The Western Blossom-headed Paroquet.
Breeds February to May.

208. **Coracias benghalensis benghalensis** (L.). The Indian Roller.
Common. Breeds April to May, making use of a hole in a tree, or sometimes in an old wall or the roof of a house.

209. **Merops orientalis orientalis** (Lath.). The Common Indian Bee-Eater.
Common. Breeds April to May.

210. **Merops superciliosus javanicus** (Horsf.). The Blue-tailed Bee-Eater.
Resident, but not so common as the last species. Breeds in large colonies on river banks from April to May.

211. **Nyctiornis athertoni** (J. & S.). The Blue-bearded Bee-Eater.
Recorded at Pachmarhi by Osmaston.

212. **Ceryle rudis leucomelanura** (Reich.). The Indian Pied Kingfisher.
Breeds from February to May.

213. **(1035) Alcedo atthis taprobana** Klein. The Common Indian Kingfisher.
Breeds from February to June.

214. **Ramphalcyon capensis gurial** (Pearson). The Brown-headed Stork-billed Kingfisher.
Resident, but not common. Observed breeding in the Balaghat District in June and July.

215. **Halcyon smyrnensis fusca** (Bodd.). The Indian White-breasted Kingfisher.
Common resident. Breeds April to July.

216. **Hydrocissa coronatus** Bodd. The Malabar Pied Hornbill.
Found in the eastern parts of the Provinces; I have observed it in the districts of Raipur, Nagpur, Bilaspur, Seoni and the Bastar State.

217. **Tockus birostris** (Scop.). The Common Grey Hornbill.
A common resident.

218. **Tockus griseus** (Lath.). The Malabar Grey Hornbill.
The species is reported as occurring in the Nimar District and I have noticed Hornbills at Khandwa which were destitute of a casque.

219. **Upupa epops epops** (L.). The European Hoopoe.
A winter visitor. One secured at Lamta in the Balaghat.

220. **Upupa epops saturata** Lönn. The Tibetan Hoopoe.
Ticehurst has identified birds from Seoni and the Deccan as of this race.

221. [**Upupa epops orientalis** (S. B.). The Indian Hoopoe.
Probably resident in the northern districts. Breeds from February to May in a hole in a tree, wall or bank.]

222. **Upupa epops ceylonensis** Reich. The Ceylon Hoopoe.
Birds from Seoni and Nagpur appear to be of this race.

223. [**Micropus melba melba** (L.). The Alpine Swift.
Recorded from Gwalgarh (McMaster).]

224. **Micropus affinis affinis** (Gray). The Common Indian Swift.
Common resident.

225. **Tachornis batassiensis palmarum** (Gray). The Palm-Swift.
Breeds from February to April and again in July.

226. [**Indicapus sylvaticus** (Tick). The White-rumped Spine-tail.
A forest species extending west to the Wyneganga and to Seoni.]

227. **Hemiprocne coronata** (Tick.). The Indian Crested Swift.
Resident, keeping to wooded tracts.

228. **Caprimulgus monticolus** (Frank.). Franklin's Nightjar.
The commonest Nightjar in the Provinces. Breeds in May and June.

229. **Caprimulgus asiaticus** (Lath.). The Common Indian Nightjar.
Common in open country, groves and low jungle. Breeds in April and May.

230. **Caprimulgus macrurus albononotus** (Tick.). The Indian Long-tailed Nightjar.
A forest species, breeding from March to May in densely-shaded ravines.

231. **Caprimulgus indicus indicus** (Lath.). The Jungle Nightjar.
Resident in well-wooded tracts.

232. **Tyto alba stertens** Hartert. The Indian Barn-Owl.
Resident. Breeds from September to January, laying from 3 to 6 white eggs in a hole in buildings or trees.

233. **Tyto longimembris** Jerdon. The Grass Owl.
Resident in the eastern districts (Balaghat, Raipur).

234. **Asio flammeus flammeus** (Ponto). The Short-eared Owl.
A winter visitor.

235. **Strix ocellata** (Less.). The Mottled Wood-Owl.
Breeds from December to February.

236. **Ketupa zeylonensis hardwickii** Gray. The Brown Fish-Owl.
Resident.

237. **Bubo bubo bengalensis** (Frank.). The Indian Great-horned Owl.
Breeds from December to April, laying 2 to 4 white eggs on a rocky ledge or in a cave, or on the ground under a brush or tuft of grass.

238. **Bubo coramandus** (Lath.). The Dusky-Horned Owl.
Occurs in the well-watered parts of Raipur where it probably breeds.

239. **Otus sunia sunia** (Hodg.). The North Indian Scops Owl.
A specimen taken at Nagpur on 2nd November.

240. **Scops bakkamoena marathi** Tice. The Collared Scops Owl.
Resident. Breeds from January to April.

241. **Athene brama indica** Frank. The Northern Indian Spotted Owlet.
Very common. Breeds February to April.

242. **Athene blewitti** (Hume). The Forest Spotted Owlet.
Found south of the Raipur District.

243. **Glaucidium radiatum radiatum** (Tick.). The Jungle Owlet.
A common resident in well-wooded localities. Breeds from March to May in holes in trees.

244. **Ninox scutulata lugubris** (Tick.). The Indian Brown Hawk-Owl.
Probably resident but not plentiful, has been taken both in open country and in forest at Nagpur and Chanda.

ORDER: ACCIPITRES.

245. **Pandion haliaëtus haliaëtus** (Linn.). The Osprey.
A winter visitor.

246. **Aegypius monachus** (Linn.). The Cinereous Vulture.
A winter visitor to the Northern districts, has been observed in Jubbulpore, Saugor and Nimar.

247. **Sarcogyps calvus** (Scop.) The Black Vulture.
Resident. Breeds on trees from January to April.

248. **Gyps fulvus fulvescens** (Hume). The Indian Griffon Vulture.
Breeds on rocky cliffs in company with the next species and lays a single white egg. The latter have been taken in October and December.

249. **Gyps indicus indicus** (Scop.). The Indian Long-billed Vulture.
Common. Habits similar to above.

250. **Pseudogyps bengalaensis** (Gmel.). The Indian White-backed Vulture.
Resident. Breeds in October and November. The nest is an irregular platform placed on a tree.

251. **Neophron percnopterus ginginianus** (Lath.). The Smaller White Scavenger Vulture.
Very common resident. Breeds February to May, making a nest of sticks on a cliff, tree or building.

252. [**Aquila heliaca** (Sav.). The Imperial Eagle.
Probably a rare winter visitor.]

253. **Aquila nipalensis nipalensis** (Hodg.). The Eastern Steppe Eagle.
A winter visitor ranging south to Raipur and Nagpur where I have taken it.

254. **Aquila rapax vindhiana** (Frank.). The Indian Tawny Eagle.
A common resident. Breeds from November to June, building a nest of sticks on trees.

255. [**Aquila clanga** (Pall.). The Greater Spotted Eagle.
Probably resident, in the Northern districts. Breeds on trees from April to June and as far south as the Tapti.]

256. **Aquila hastata** (Less.). The Small Indian Spotted Eagle.
Resident in the Eastern districts. Has been observed breeding in Raipur and Bilaspur.

257. **Hieraëtus fasciatus fasciatus** Vieill. Bonellis Eagle.
Resident but not common. Breeds December to February.

258. **Hieraëtus pennatus** Gmel. The Indian Booted Eagle.
Specimens obtained at Hoshangabad and Nagpur.

259. **Butastur teesa** (Frank.). The White-eyed Buzzard.
A common resident. Breeds in April.

260. **Haliaëtus leucorypha** (Pall.). Pallas' Fishing Eagle.
Resident. Breeds in November.

261. [**Ichthyophaga ichthyaëtus** (Horsf.). The Large Grey-headed Fishing Eagle.
Resident. MacArthur took an egg at Ramtek on 20th November.]

262. **Ichthyophaga humilis plumbeus** (Jerd.). The Himalayan Fishing-Eagle.
Specimens of this Fishing Eagle have been taken by Mr. A. Donald in the Melghat.

263. **Haliastur indus indus** (Bodd.). The Brahminy Kite.
Resident. Breeds in February.

264. [**Ictinaetus malayensis perniger** (Hodg.). The Indian Black Eagle.
Jerdon is said to have seen this species in Central India (? Bastar) and MacArthur declares he took an egg probably of this species in April in the Bilaspur District.]

265. **Limnaëtops cirrhatus cirrhatus** (Gmel.). The Indian Hawk Eagle.
Resident. The nest is placed on a high tree, in which a single egg is laid at some time from January to April.

266. [**Limnaetops nepalensis nepalensis** (Hodg.). Hodgson's Hawk-Eagle.
Reported to have been found in winter as far south as Seoni and Pachmarhi, but these may just as well have been *L. n. kelaarti*, Legge's Hawk Eagle.]

267. **Circaëtus gallicus** (Gmel.). The Short-toed Eagle.
Resident. Breeds on trees (rarely on cliffs), and lays a single egg between January and May in a loosely constructed nest of sticks.

268. **Haematornis cheela minor** (Hume). The Indian Lesser Crested Serpent Eagle.
Breeds on trees from March to May.

269. **Milvus migrans govinda** (Sykes). The Common Pariah Kite.
Breeds from October to February.

270. **Milvus migrans lineatus** (Gray). The Black-eared Kite.
A winter visitor.

271. **Elanus caeruleus vociferus** (Lath.). The Black-winged Kite.
Breeds in December and January.

272. **Circus macrourus** (Gmel.). The Pale Harrier.
A common winter visitor.

273. **Circus pygargus** (Linn.). Montagu's Harrier.
A winter visitor.

274. [**Circus cyaneus** (Linn.). The Hen Harrier.
A straggler to the Provinces in winter.]

275. **Circus melanoleucus** (Forst.). The Pied Harrier.
A winter visitor to the Eastern districts. I have observed it at Paraswara in the Balaghat District, and at Nawegaon, Bhandara District.

276. **Circus aeruginosus aeruginosus** (L.). The Marsh Harrier.
A common winter visitor. I once observed one feeding on carrion and keeping at bay a crowd of vultures.

277. [**Buteo rufinus** (Cret.). The Long-legged Buzzard.
A rare winter visitor. Has been taken at Raipur.]

278. **Astur badius dussumieri** (Temm.). The Shikra.
Common resident. Breeds April to May.

279. **Astur trivirgatus indicus** Pearson. The Crested Goshawk.
A rare forest bird, probably resident. I have taken it at Nagpur and in the Balaghat District.

280. **Accipiter nisus nisosimilis** (Tick.). The Asiatic Sparrow-Hawk.
A winter visitor. Has been taken at Khatkali in the Melghat and at Nagpur.

281. **Pernis ptilorhynchus ruficollis** (Less.). The Indian Crested Honey-Buzzard.
Resident. Breeds April to July.

282. **Falco peregrinus calidus** (Lath.). The Eastern Peregrine Falcon.
Taken on the banks of the Nerbudda in winter.

283. **Falco peregrinus peregrinator** (Sund.). The Indian Peregrine or Shahin Falcon. Resident but not common. The nest is a mass of sticks, placed on a cliff.

284. [**Falco peregrinus babylonicus** (Gur.). The Red-capped or Barbary Falcon. A rare winter visitor. A specimen has been taken at Raipur.]

285. **Falco jugger** (Gray). The Lagger Falcon.
Resident.

286. **Falco subbuteo subbuteo** (L.). The Hobby.
A winter visitor. I took a specimen at Nagpur, and it has been taken at Raipur.

287. **Falco chiquera chiquera** (Daud.). The Red-headed Merlin.
Resident. Breeds January to May, generally about February.

288. **Falco tinnunculus objurgatus** S.B. The Indian Kestrel.
The Kestrels have not yet been worked out for want of material, two races are probably winter visitors, and a third is resident. A clutch of three has been taken in the Saugor District on 30th September.

ORDER: COLUMBAE.

289. [**Crocopus phoenicopterus phoenicopterus** (Lath.). The Bengal Green Pigeon.
Recorded as occurring with the next species at Pachmarhi.]

290. **Crocopus phoenicopterus chlorogaster** (Blyth). The Southern Green Pigeon.
Resident.

291. **Sphenocercus sphenura** (Vig.). The Wedge-tailed Green Pigeon or Kokla.
Osmaston records this species as a very rare visitor to Pachmarhi in April.

292. **Muscadivora aenea sylvatica** (Tick.). The Northern Green Imperial Pigeon.
Occurs in the Bastar State, and Chanda with a wing measurement of 220 to 225 mm.

293. **Chalcophaps indica** (L.). The Emerald Dove.
Resident in forest country in the Balaghat District.

294. **Columba livia intermedia** (Strick.). The Indian Blue Rock-Pigeon.
Resident, but more plentiful in the wheat-growing areas; scarce in the cotton-growing tracts except near the vicinity of cliffs or old forts where large colonies usually establish themselves.

295. **Streptopelia orientalis ferrago** Evers. The Indian Turtle Dove.
A winter visitor.

296. **Streptopelia orientalis meena** (Sykes). The Indian Rufous Turtle Dove.
Resident. I have taken it in June at Nagpur and in January at Paraswara (Balaghat District).

297. **Streptopelia chinensis suratensis** (Gm.). The Spotted Dove.
Resident, partial to forest areas. Breeds almost throughout the year.

298. **Streptopelia senegalensis cambayensis** (Gm.). The Little Brown Dove.
Resident. Breeds almost throughout the year.

299. **Streptopelia decaocto decaocto** (Friv.). The Indian Ring-Dove.
Resident. Breeds throughout the year.

300. **Oenopopelia tranquebarica** (Herm.). The Indian Red Turtle-Dove.
Resident. Breeds almost throughout the year.

ORDER: PTEROCLETES.

301. **Pterocles indicus** (Gmel.). The Painted Sandgrouse.
Resident. Breeds chiefly in March, April and May.

302. **Pterocles exustus erlangeri** (Neum.). The Common Indian Sandgrouse.
Resident.

ORDER: GALLINAE.

303. **Pavo cristatus** (L.). The Common Peafowl.
Breeds June to September. Albino peafowl have been reported from the Bastar State.

304. **Gallus bankiva** R. & K. The Indian Jungle-Fowl.
Resident in the eastern half of the Provinces, Balaghat, Bhandara, Bastar, etc., extending west into the Chanda District, and across the Pench River.

305. **Gallus sonneratii** (Temm.). The Grey Jungle-Fowl.
Resident throughout the Nerbudda Valley west of Jubbulpore, the Melghat, and the Chanda District.

306. **Galloperdix spadicea spadicea** (Gmel.). The Red Spur-Fowl.
Resident. Birds from the Nimar District appear to be *G. s. caurina*, Bf.

307. **Galloperdix lunulata** (Val.). The Painted Spur-Fowl.
Resident.

308. **Excalfactoria chinensis** (L.). The Blue-throated Quail.
Probably resident in the eastern parts of the Provinces.

309. **Coturnix coturnix coturnix** (L.). The Common Quail.
A winter visitor rarely breeding in the Provinces.

310. **Coturnix coromandelica** (Gmel.). The Black-breasted or Rain-Quail.
Resident.

311. **Perdicula asiatica asiatica** (Lath.). The Jungle Bush-Quail.
Resident. Breeds September to February.

312. **Perdicula asiatica argoondah** (Sykes). The Rock Bush-Quail.
Resident in the Western Central Provinces.

313. **Coryptoplectron erythrorhynchum blewitti** (Hume). Blewitt's Bush-Quail.
Resident in the forest regions of the Eastern Central Provinces (Mandla, Balaghat, Seoni, Chanda, Raipur and Bastar).

314. [**Francolinus francolinus asiae** (Bonap.). The Indian Black Partridge.
May be resident in the extreme north of the Provinces. ?]

315. **Francolinus pictus pictus** (J. & S.). The Southern Painted Partridge.
Resident in the southern parts of the Provinces (Raipur, Chanda and Balaghat). Breeds during the rains.

316. **Francolinus pictus pallidus** (Grey). The Northern Painted Partridge.
Resident in the Northern and Western portions of the Provinces. The races of the Painted Partridges in the Central Provinces have not yet been properly investigated.

317. **Francolinus pondicerianus interpositus** (Hart.). The Northern Grey Partridge.
Breeds February to June and sometimes again from September to November.

ORDER: HEMIPODII.

318. **Turnix suscitator taijoor** (Sykes). The Common Bustard Quail.
Breeds chiefly during the rains (June).

319. **Turnix dussumieri** (Temm.). The Little Button-Quail.
Resident. Breeds chiefly from June to September.

320. **Turnix maculatus tanki** (Blyth). The Indian Button-Quail.
Resident. Breeds May to September.

ORDER: GRALLAE.

321. [**Rallus aquaticus korejewi** Sar. The Turkestan Water Rail.
A straggler in winter. Has been taken at Sehore.]

322. [**Hypotaenida striata gularis** Horsf. The Indian Blue-Breasted Banded Rail.]

323. [**Porzana porzana** L. The Spotted Crake.
May be a straggler in winter.]

324. **Porzana pusilla pusilla** (Pallas). The Easten Baillons Crake.
Taken at Nagpur in April and May and observed elsewhere in winter.

325. **Amaurornis phoenicurus chinensis** (Bodd.). The Chinese White-Breasted Water Hen.
Breeds probably from May to September; clutches of 4 and 5 taken in Bhandara in July. A bird from Nagpur had a wing measurement of 156 mm.

326. **Amaurornis akool akool** (Sykes). The Brown Crake.
Resident.

327. **Gallinula chloropus indicus** (Blyth). The Indian Moorhen.
Breeds from July to September.

328. **Porphyrio poliocephalus poliocephalus** (Lath.). The Indian Purple Coot.
Breeds in September.

329. **Fulica atra atra** (L.). The Coot.
Breeds in September in a nest very similar to that of the Purple Coot.

330. **Metopidius indicus** (Lath.). The Bronze-winged Jacana.
Breeds from June to September.

331. **Hydrophasianus chirurgus** (Scop.). The Pheasant-tailed Jacana.
Nidification similar to that of the Bronze-winged Jacana.

332. **Rostratula benghalensis benghalensis** (L.). The Painted Snipe.
Resident. Breeds at all seasons.

333. **Grus grus lilfordi** (Sharpe). The Eastern Crane.
A winter visitor to the Nerbudda Valley.

334. **Grus leucogeranus** (Pallas). The Great White or Siberian Crane.
A straggler was shot by McMaster at Kuhi near Nagpur.

335. **Antigone antigone antigone** (L.). The Sarus.
Resident. Breeds in July and August and also in March.

336. **Anthropoides virgo** (L.). The Demoiselle Crane.
A winter visitor keeping to the larger river basins.

337. **Choriotes nigriceps,** Vig. The Great Indian Bustard.
Resident. Breeds October to December, laying a single egg, in a hollow on the ground with or without a lining of grass. Females sometimes have the black pectoral band complete and distinct.

338. **Sypheotides indica** (Gmel.). The Lesser Florican or Likh.
Breeds in August and September.

ORDER: CHARADRIFORMES.

339. **Burhinus oedicnemus indicus** (Salv.). The Indian Stone-Curlew.
Breeds from February to August, but chiefly in April.

340. **Esacus recurvirostris** (Cuv.). The Great Stone-Plover.
Resident. Lays two eggs between February and June in river-beds on the sand or amongst stones.

341. **Cursorius coromandelicus** (Gmel.). The Indian Courser.
Breeds from March to July.

342. **Rhinoptilus bitorquatus** (Jerd.). Jerdon's Courser.
A rare bird found at Sironcha.

343. **Glareola maldivarum** (Forst.). The Large Indian Swallow-Plover.
Resident. Breeds in May.

344. **Glareola lactea** (Temm.). The Small Indian Pratincole.
Breeds in company with Terns, on sandbanks in the larger rivers from March to May.

345. **Larus brunnicephalus** (Jerd.). The Brown-headed Gull.
A specimen was shot on the Telinkeri Tank, Nagpur, on 17th June.

346. **Larus argentatus cachinnans** Pallas. Yellow-legged Herring-Gull.
Taken on the Mahanaddy River at Chandrapur in November.

347. [**Chlidonias leucopareia indica.** The Indian Whiskered Tern.
A winter visitor.]

348. **Chlidonias l. leucoptera.** White-winged Black Tern.
Has been taken at Raipur.

349. **Gelochelidon nilotica nilotica.** The Gull-billed Tern.
Observed on the Mahanaddy River.

350. **Sterna seena** (Sykes). The Indian River Tern.
Breeds gregariously in March, April or May in a depression on a sandbank.

351. **Sterna melanogaster** (Temm.). The Black-bellied Tern.
Nidification similar to that of *S. seena* and frequently breeding in company with it.

352. **Rhynchops albicollis** (Swains.). The Indian Skimmer.
Resident on the Nerbudda and Mahanaddy Rivers. Breeds from March to April after the fashion of other terns and in company with them.

353. [**Charadrius dubius curonicus** Gmel. The European Little Ringed Plover.
A winter visitor.]

354. **Charadrius dubius jerdoni** (Legge). Jerdon's Little Ringed-Plover.
Breeds from February to March, but probably later and earlier as well.

355. **Pluvialis dominicus fulvus** Gmel. The Eastern Golden Plover.
Taken on the Mahanaddy River, near Chandrapur.

356. **Hoplopterus duvaucelli** Lesson. The Spur-winged-Plover.
Observed in the Nerbudda and Indravati Rivers. Breeds from March to May.

357. **Lobivanellus indicus indicus** (Bodd.). The Indian Red-wattled Lapwing.
Breeds chiefly from April to June, laying 4 eggs in a small hollow.

358. **Lobipluvia malabarica** (Bodd.). The Yellow-wattled Lapwing.
Breeds from May to July.

359. **Himantopus himantopus himantopus** L. The Back-winged Stilt.

360. **Numenius arquata arquata** Lin. The Western Curlew.
All curlews which I have shot on the Mahanaddy River have proved to be of this race. They were generally in small flocks.

361. **Numenius arquata orientalis** Brehm. The Eastern Curlew.
A winter visitor. All birds shot on inland tanks in the Bhandara and Nagpur districts were of this race. They were either solitary or in small flocks of 4 or 5 birds.

362. **Limosa limosa limosa.** The Black-tailed Godwit.
A rare winter visitor, one shot on the Sonagaon tank 4 miles south of Nagpur. It was a solitary bird associating with one other wader.

363. [**Macroramphus semipalmatus** (Jerd.). The Snipe-billed Godwit.
A specimen is said to have been killed at Raipur by Capt. S. L. Wood (Asian 22 Februay 1894, page 377).]

364. **Tringa ochropus** (L.). The Green Sandpiper.
A very common winter visitor. It has been observed at Nagpur on the 14th September and some birds remain till June.

365. **Tringa stagnatilis** (Becks.). The Marsh Sandpiper.
A winter visitor to the Northern districts (Jubbulpore, Seoni, etc.).

366. **Tringa hypoleuca** (L.). The Common Sandpiper.
A winter visitor.

367. **Tringa glareola** (L.). The Wood Sandpiper.
Very common winter visitor.

368. **Tringa totanus** (L.). The Redshank.
Observed on the Mahanaddy River.

369. **Glottis nebularia** (Gunner). The Greenshank.
A winter visitor.

370. **Philomachus pugnax** (L.). The Ruff and Reeve.
A winter visitor, solitary individuals as well as large flocks have been seen.

371. **Erolia minuta** (Leister). The Little Stint.
A winter visitor, common on the Nerbudda.

372. **Erolia temminckii** (Leister). Temminck's Stint.
A winter visitor.

373. [**Erolia alpina alpina,** Lin. The Eastern Dunlin.
A straggler to the Province in winter.]

374. **Capella nemoricola** (Hodg.). The Wood Snipe.
Occurs on migration, has been taken at Mandla, Pachmarhi, Amarkantak, Balaghat and Serguja.

375. **Capella gallinago gallinago** (L.). The Common Fantail Snipe.
A winter visitor.

376. **Capella stenura** (Bonap.). The Pintail Snipe.
A winter visitor, more plentiful than the last species.

377. **Lymnocryptes minima** (Brunn.). The Jack Snipe.
A winter visitor.

ORDER: STEGANOPODES.

378. Pelicans have been observed in the Northern districts in the rains and also in the Eastern districts, but whether they are *P. onocrotalus* or *P. philippensis* or both, has not been ascertained.

379. **Phalacrocorax carbo sinensis** (S. & N.). The Indian Large Cormorant.
Resident, but not plentiful, nests on trees growing in water. An incomplete clutch of 2 eggs was taken on the 13th July in the Balaghat District.

380. [**Phalacrocorax fuscicollis** (Steph.). The Indian Shag.
A rare bird if it occurs at all.]

381. **Phalacrocorax niger** Vieill. The Little Cormorant.
Resident. Breeds in colonies in July.

382. **Anhinga melanogaster** (Penn.). The Indian Darter or Snake-bird.
Breeds in colonies, and generally in company with Cormorants and Herons, on trees in or near water.

ORDER: HERODIONES.

383. **Platalea leucorodia major** (Temm.). The Indian Spoonbill.
Observed in the northern and eastern districts.

384. **Threskiornis melanocephalus** (Lath.). The White Ibis.
Resident. Breeds gregariously from June to August constructing a stick nest on a large tree.

385. **Pseudibis papillosus** (Temm.). The Indian Black Ibis.
Resident. Breeds at various seasons, March and April and again from August to December.

386. **Plegadis falcinellus falcinellus** The Glossy Ibis.
Taken on the Mahanaddy, the birds were in a very large flock.

387. **Dissoura episcopa episcopa** (Bodd.). The Indian White-necked Stork.
A common resident. Breeds from June to August.

388. **Xenorhynchus asiaticus asiaticus** (Lath.). The Black-necked Stork.
Resident, breeds from October to December.

389. **Leptoptilus javanicus** (Horsf.). The Smaller Adjutant.
Most probably resident.

390. **Pseudotantalus leucocephalus leucocephalus** (Penn.). The Painted Stork.
Breeds gregariously often on trees growing near villages and makes a small nest of sticks.

391. **Anastomus oscitans** (Bodd.). The Open-bill.
Breeds gregariously from April to July.

392. **Ardea purpurea manillensis** (Meyen.). The Eastern Purple Heron.
Breeds from April to August, making a huge stick nest in thickets or in dense clumps of bulrushes.

393. **Ardea cinerea rectirostris** Gould. The Eastern Grey Heron.
Resident.

394. [**Ardea goliath** Gret. The Giant Heron.
Casual, Blanford once saw them near Nagpur (Kuhi).]

395. **Egretta alba modesta** (Gray). The Eastern Large Egret.
All the Egrets are resident and breed gregariously in July on trees, making nests of sticks.

396. **Egretta intermedia intermedia** (Wagler). The Smaller Egret.

397. **Egretta garzetta garzetta** (Linn.). The Little Egret.

398. **Bubulcus ibis coromandus** (Bodd.). The Cattle Egret.
Breeds from June to August.

399. **Demiegretta asha** (Sykes). The Indian Reef-Heron.
A specimen was observed on the Telinkheri Tank, Nagpur, and another on the Mahanaddy.

400. **Ardeola gravii** (Sykes). The Indian Pond Heron.
Breeds in July and August, making a stick nest on a tree, several pairs often nesting in company.

401. **Butorides striatus javanicus** (Horsf.). The Indian Little Green Heron.
Breeds May to August.

402. **Nycticorax nycticorax nycticorax** (Linn.). The Night Heron.
Breeds July to September in company with Egrets and other Herons.

403. **Ixobrychus cinnamomeus** (Gmel.). The Chestnut Bittern.
Resident. Three eggs were taken from a nest placed amongst reeds in the Bhandara District in September. A specimen was also secured at Nagpur in April.

404. [**Dupetro flavicollis flavicollis** (Lath.). The Black Bittern.
Reported to be resident.]

405. **Botaurus stellaris stellaris** (Linn.). The Bittern.
A winter visitor.

ORDER: PHOENICOPTERI.

406. **Phoenicopterus ruber antiquorum** (Temm.). The Common Flamingo.
Flocks of flamingoes are now and then seen flying over or settling in the Nagpur tanks. On the 9th June 1912 a large flock was observed on the Ambajheri Tank and on the 27th June 1912 I obtained a specimen out of a flock on the Gorewara Tank.

407. **Phoeniconaias minor** (Geoffr.). The Lesser Flamingo.
A specimen was shot on the 9th June 1912, associating with a flock of the larger species. In the winter of the same year I also saw a quantity of these birds being hawked about for sale.

ORDER: ANSERES.

408. **Sarkidiornis melanotus** (Penn.). The Nukhta or Comb-Duck.
Resident. Breeds on trees, placing the nest in a hole in the stem or in a depression between the larger branches.

409. **Asarcornis scutulatus** (Muller). The White-winged Wood Duck.
A specimen is said to have been shot in the Bilaspur District by Mr. E. H. Young (*J.B.N.H.S.*, vol. xii, p. 572).

410. **Nettopus coromandelianus** (Gmel.). The Cotton Teal.
Breeds in July and August in holes in trees.

411. [**Anser anser** (Linn.). The Grey Lag Goose.
Winter visitor to the Nerbudda.]

412. **Anser indicus** (Lath.). The Bar-headed Goose.
A winter visitor, very common on the Nerbudda. A solitary individual was shot in a tank at Naghbir in the Chanda District.

413. **Dendrocygna javanica** (Horsf.). The Whistling Teal.
Resident; makes a nest of sticks in a tree, occupies an old nest of a crow or heron, or builds in grass or thorny shrub near water.

414. [**Dendrocygna fulva.** The Large Whistling Teal.
Oates in Humes' *Nests and Eggs* records a nest found at Saugor, taken from a large hollow in a tree.]

415. **Casarca ferruginea** (Pall.). The Ruddy Sheldrake or Brahminy Duck.
A winter visitor, keeping to the wider streams and rivers.

416. **Anas platyrhyncha platyrhyncha** (Linn.). The Mallard.
An occasional winter visitor to the northern district.

417. **Anas poecilorhyncha poecilorhyncha** (Fors.). The Indian Spotbill.
Resident, breeds July to September.

418. **Chaulelasmus streperus** (Linn.). The Gadwall.
A winter visitor.

419. [**Mareca penelope** (Linn.). The Widgeon.
Probably an irregular winter visitor.]

420. **Nettion creca creca** (Linn.). The Common Teal.
A winter visitor.

421. **Dafila acuta** (Linn.). The Pintail.
A winter visitor.

422. **Querquedula querquedula** (Linn.). The Garganey or Blue-winged Teal.
A winter visitor, staying with us till about the middle of April. It is one of the common ducks of the Provinces.

423. **Spatula clypeata** (Linn.). The Shoveller.
A winter visitor.

424. [**Marmaronetta angustirostris,** Mene. The Marbled Teal.
Occasionally wanders into the Provinces.]

425. **Netta rufina** (Pallas). The Red-crested Pochard.
A winter visitor.

426. **Nyroca ferina ferina** (Linn.). The Pochard or Dun-bird.
A winter visitor.

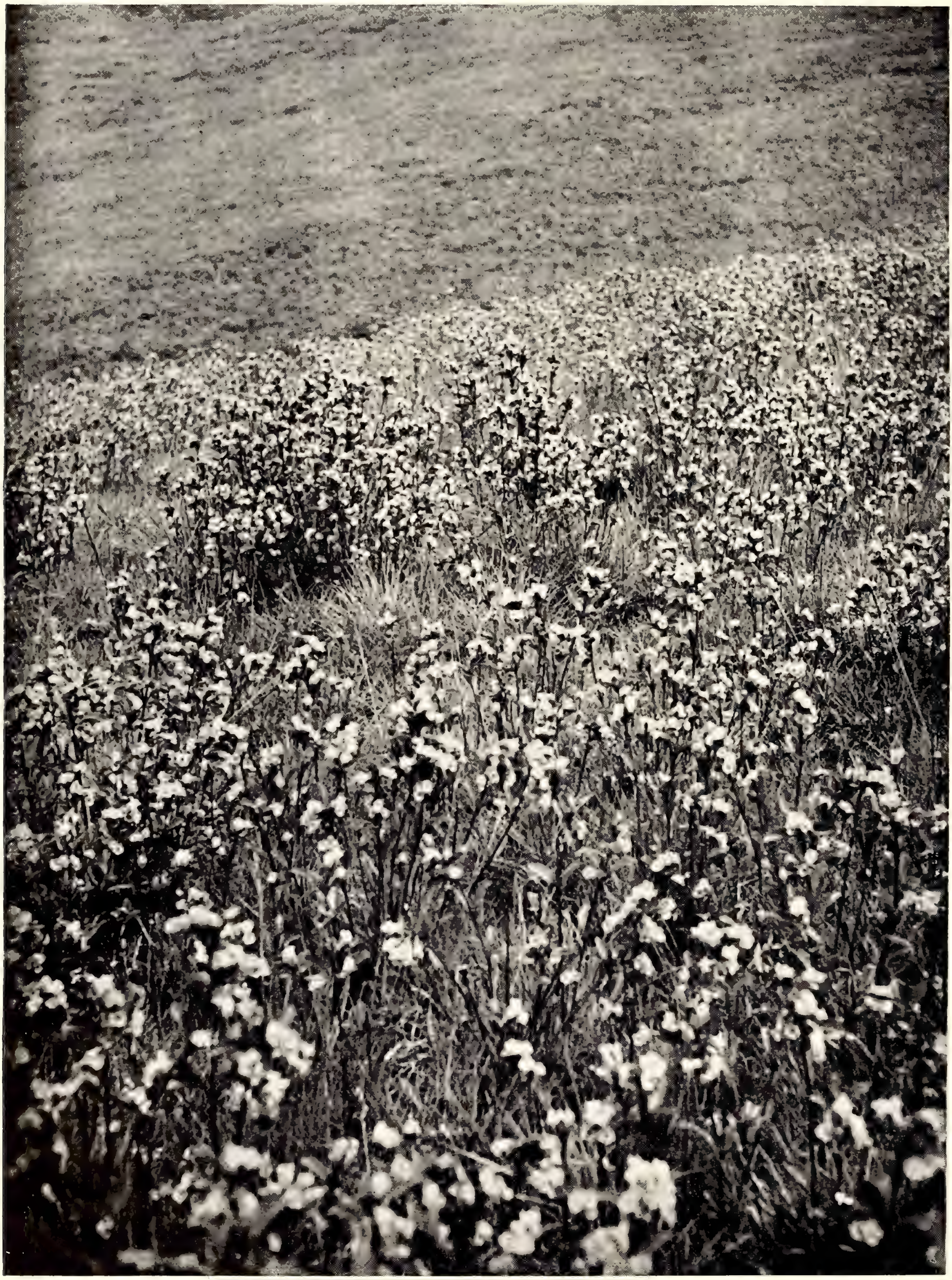
427. **Nyroca rufa rufa** (Linn.). The White-eyed Duck.
A winter visitor and perhaps the commonest Duck.

428. **Nyroca fuligula** (Linn.). The Tufted Duck.
A winter visitor.

429. **Merganser merganser orientalis** (Gould). The Eastern Goosander.
A winter visitor, has been shot at Arang on the Mahanaddy in the Raipur District. The Smew (*Mergus albellus*) is probably also found on the Nerbudda.

ORDER: PYGOPODES.

430. **Podiceps ruficollis capensis** Salo. The Indian Little Grebe or Dabchick.
A common resident. The breeding season is from July to September.



Strobilanthes Kunthianus T. And. in flower on a hillside in the Pulneys, 1934.

THE FLOWERING OF *STROBILANTHES* IN 1934.

BY

M. E. ROBINSON.

(*With eight plates*).

This paper makes no pretensions to be a scientific study of the interesting genus *Strobilanthes*, but is merely a short account of a few of the species that flowered on the hills of South India, during the year 1934.

The genus was exhaustively studied by Robert Wight and Col. Beddome, who did so much for Indian Botany during the latter half of the nineteenth century, and each described over twenty species, making illustrations of forty species in their *Icones Plantarum*. Gamble describes fortysix species in the Flora of the Madras Presidency, and Fyson has also given descriptions and illustrations of several of the more common species in his 'Flora of the Nilgiri and Pulney Hill tops'. As these works of reference may not be readily available to the general reader, a photograph and drawings are given here to illustrate the species mentioned.

The best known of the Strobilanthes is *Strobilanthes Kunthianus* which flowers in greater profusion than any other species; so much so indeed, as to earn for itself the name of the 'great blue flower of the Nilgiris', and to colour whole tracts of country with sheets of its delicate blue. But not every year. In fact only once in twelve years is this remarkable sight to be seen; and though in the intervening years occasional plants can be found here and there in flower, and in some years quite a number may be found, the full gregarious flowering, when whole hillsides are covered with the plants, every one bearing great bunches of mauve-blue flowers, takes place only at intervals of twelve years. The year 1934 has seen such a flowering. Its last appearance was in 1922, and before that in 1910. Records of its appearance in 1898 and 1886 have been made by various observers and Mr. Cockburn of Kotagiri, in the Nilgiris, has given me a remarkable record of its flowerings during a hundred years. His grandfather was one of the first European settlers on the Nilgiris in 1826, and his aunt first saw Strobilanthes in flower in 1838 when she was a child of nine; and saw and recorded Strobilanthes in full flower in 1850, 1862, 1874, 1886, 1898, 1910 and 1922.

This seems to establish the twelve year period fairly well, though other dates have been given for its appearance such as 1848, 1908, 1925, 1932, which suggest a more irregular period. Gamble indeed says 'probably about six years' and Fyson says 'irregular intervals from seven to twelve years'. Some specimens were sent me from the Nilgiris purporting to be of an 'eight year variety' but these were *S. Kunthianus* exactly the same as the twelve year plant. From the information I have gathered and the above mentioned record, I should think it probable that a full flowering takes place only once in twelve years, with lesser outbursts of flowering in scattered areas at other times. The year 1934 has undoubtedly been a year of full flowering on all the hills. There were acres of blue flowers on the Pulney Hills from the beginning of July until December, when there were still isolated patches in the more sheltered valleys round Poombarai, though the open hillsides were covered with the dead and blackening bushes. On the Nilgiris it did not appear in full flower until August, and in October a hillside above Wellington was blue, and much could still be found round Pykara and Kotagiri. On the Anamalais it appeared only in October and covered the grass hills there with sheets of bloom.

The plant varies very much in size according to its habitat. On the open hills and grass lands it is short and close, being often only one to two feet high; whereas at the sides of the roads, and in the sholas it grows into strong bushes eight to ten feet in height. The flowers vary in colour also from a very pale lilac blue, almost white, to a deep purplish blue.

It is noted by all who have seen two or three flowerings, that at each successive period, the area over which it appears becomes less and less. Every year more land in these hills is taken up and cleared for tea estates, or for fruit and vegetable culture, or for building. Many a hillside that was once blue with Strobilanthes, is now green with the little flat topped tea bushes, and Strobilanthes is ruthlessly exterminated as a pest. It must have been a wonderful sight when first seen by a European, when there were no estates, and no habitations other than the scattered hill villages, and one can only regret the loss of so much beauty. It is easy to understand the awe and veneration with which the simple hill people would look upon this marvellous flower, appearing at such long intervals, and there are to this day old people among the Todas, Badagas and Kotas, who refer to the number of times they have seen 'the great blue flower' in chronicling the chief events of their lives.

One interesting result of the gregarious flowering of Strobilanthes is the large increase in the number of bees found in its vicinity during its flowering period. Each flower secretes honey in a small disc below the ovary, so that immense quantities of honey must be available, and two different kinds of honey bees visit the flowers. The large dark tipped rock bee (*Apis dorsata*) and the dark hill variety of the common Indian honey bee (*Apis indica*) are both visitors to Strobilanthes, and their curious hanging hives are very conspicuous. In 1922 as many as 28 were found hanging from one Eucalyptus tree near Kodaikanal, and 32 were counted on an overhanging rock; while 7 swarms took place on the verandah of a college building at Shembaganur.

This large production of honey tempts the hill bears to come in search of their favourite food, and round Kotagiri, in the Nilgiris, a considerably larger number of them were seen in 1934, The honey is said to have a peculiar flavour when Strobilanthes is in flower, being rather more bitter than usual.

The genus *Strobilanthes* belongs to the natural order *Acanthaceae*. The chief characteristics of the genus are as follows:—

(1) A gamopetalous bell-shaped corolla which narrows gradually towards the base in some species, as *S. Kunthianus* while in some others the bell passes suddenly into a narrow tube as in *S. foliosus*.

(2) The inflorescence is a spike, the flowers being enclosed in overlapping bracts; the spike is elongated in some species as *S. Kunthianus* and *S. consanguineus*; in others short and close or capitate as in *S. foliosus* and *S. Wightianus*. The overlapping bracts are supposed to give the inflorescence somewhat the appearance of a pine cone from which the genus takes its name, *strobile* being the Greek word for pine cone.

(3) There are either two or four stamens, sometimes two fertile and two infertile.

(4) The long style ends in a bilobed stigma with unequal lobes.

(5) The superior ovary is seated on a honey secreting cushion or disc.

(6) The leaves are opposite, simple and usually dentate with conspicuous veins.

(7) Many of the species are very hairy, as *S. Wightianus; S. Perrottetianus* with red hairs; *S. urceolaris*, sticky with an aromatic scent; *S. Lawsoni* long silky hairs, densely covering the plant.

(8) With few exceptions, nearly all the species flower only at intervals of a number of years. In most species the period is not definitely established.

The following eight species were found flowering on the Nilgiris and Pulneys during 1934.

(A) *Flowers having two stamens*:—

(1) *Strobilanthes Kunthianus* T. And: (Pls. I and II). Found on the Nilgiris, Pulneys, Anamalais, High Range, Shevaroys, Billigirirangans; period 12 years; a woody shrub found in the open and in sholas, varying with locality from 1½ to 10 ft. in height.

Smooth reddish stem, bearing opposite leaves almost white below with soft short hairs between the veins. There are two types of leaves, the more common longer than broad, with pointed tip; less common shorter, as broad as long, and a broad rounded tip. The edge is toothed and the veins conspicuous 8-10 pairs; inflorescence rather long spike; bracts slightly hairy.

Corolla pale to deep mauve blue, bell narrowing gradually to the base.

(2) *Strobilanthes foliosus* T. And: (Pl. III). Found on Nilgiris and Pulneys and reported from other hill ranges; at edges of sholas only; quite common and said to flower every year; shrub 10 or 12 ft. high.

Smooth grey-brown stem; leaves opposite quite smooth; broad with pointed tip; toothed edge.

Inflorescence short and compact, supported by four outer leaves with large bases surrounding the spike. Outer bracts also somewhat leafy, quite smooth.

Corolla pale blue, with a long narrow tube as long as the bell; stamens two long and two very small infertile ones at the base of the long ones.

(3) *Strobilanthes consanguineus* C. B. Clarke: (Pl. IV). Found on the Pulneys at about 5,000 ft. and below to 3,500 ft.; abundant at the edges of sholas and the road; Gamble says its period is about 12 years, it having been previously recorded in flower in 1909, 1897 and 1884.

Shrub 10 or 12 ft. high glabrous, except the inflorescence which is sticky; leaves rather large, long-stalked and with a long point; toothed edge.

Inflorescence very long and slender spike, often three or more together; bracts with sticky hairs; flowers rather small, very pale lilac, short tube below the bell.

(4) *Strobilanthes Lawsoni* Gamble: (Pl. V). Found on the Nilgiris and previously collected in 1917 and 1883; so its period may be about 17 years; cultivated in a few gardens on the Nilgiris for the sake of its foliage; the whole plant densely covered with long white silky hairs.

Inflorescence a long spike; corolla pale blue with a rather short tube; stamens with white silky hairs.

(B) *Flowers having four stamens*:—

(5) *Strobilanthes Zenkerianus* T. And: (Pl. III). Found on the Nilgiris and Pulneys; a shrub so like *S. foliosus* that it is difficult to distinguish them at first sight; leaves perhaps smaller, darker green and of tougher consistency.

Inflorescence a short compact head; similar to that of *S. foliosus* but the outer leaves surrounding the head are wanting, and these are true bracts, very leafy.

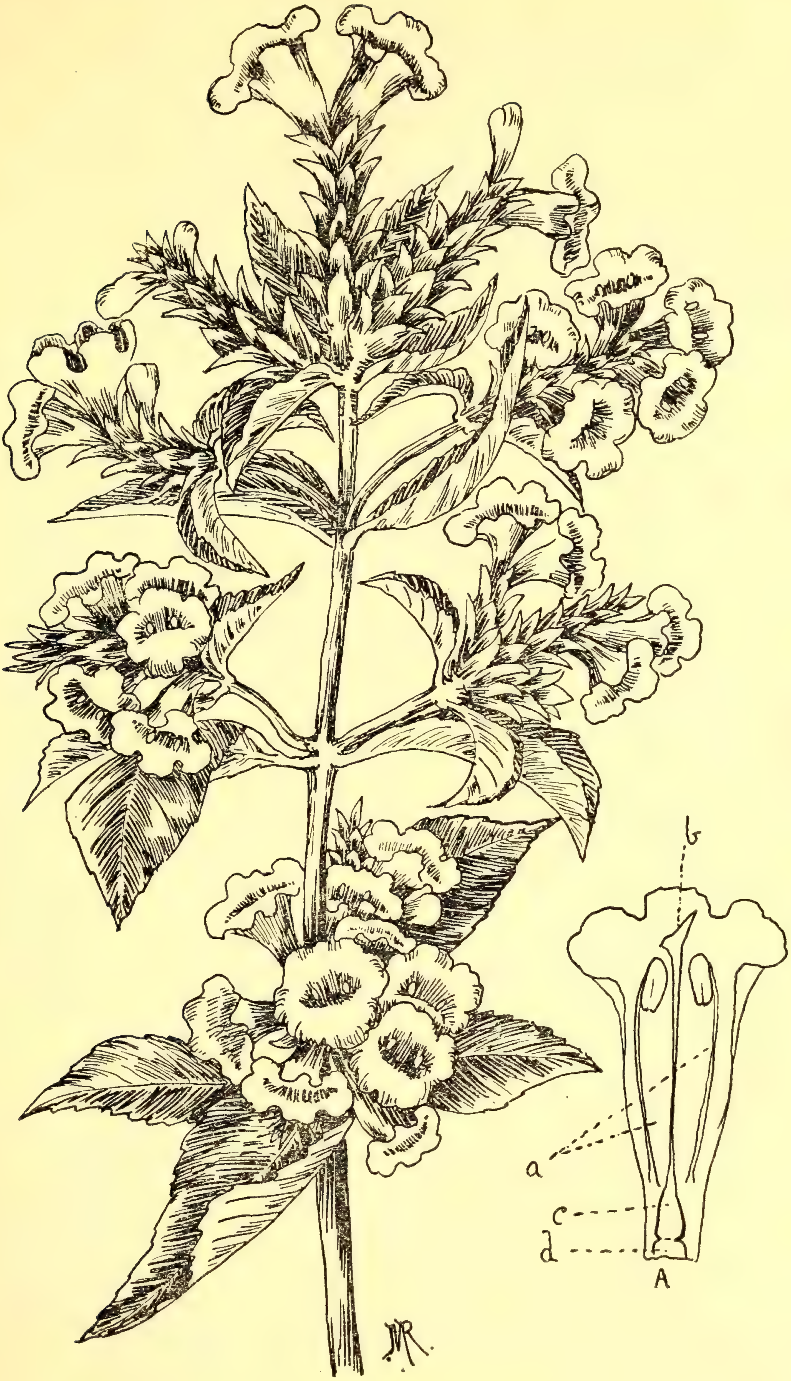
Flower similar in blue colour and long tube below the bell; stamens four fertile, two long and two short; the distinguishing characteristic between this species and *S. foliosus*. In dried specimens it is often difficult to tell whether the two small stamens are fertile or infertile.

(6) *Strobilanthes Wightianus* Nees: (Pl. VI). Found on the Nilgiris, very abundant in 1934 but said to flower every year; easily recognised; very roughly hairy shrub 6 to 8 ft. high at the edges of sholas; short and compact, often only one foot high on the open roadsides; leaves rather short and broad; short stalks and very hairy.

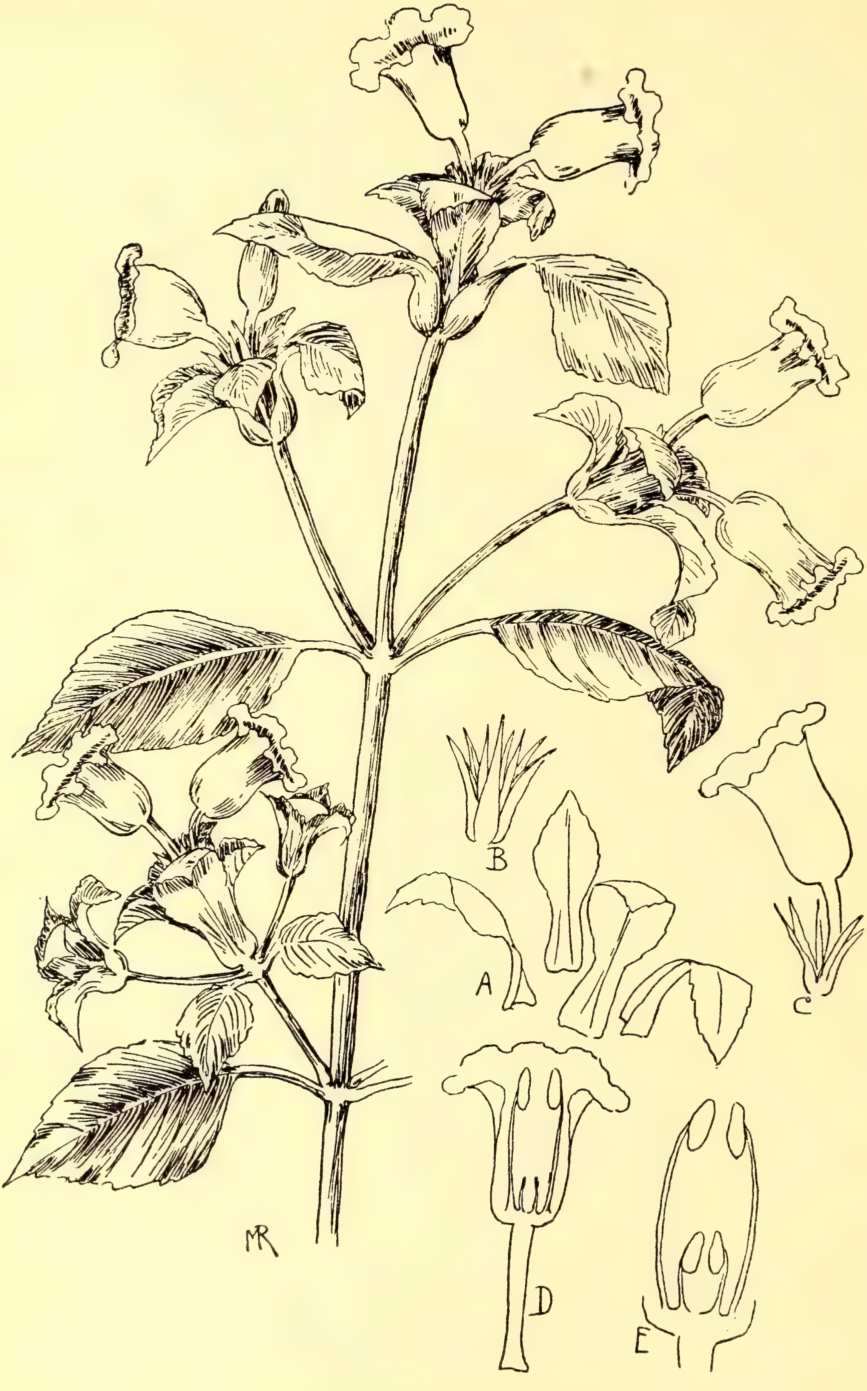
Inflorescence short compact head, bracts leafy and very hairy.

Corolla large pale blue with dark blue lines and the tube and throat brown, showing up the four yellow stamens all of the same length; very short tube below the bell.

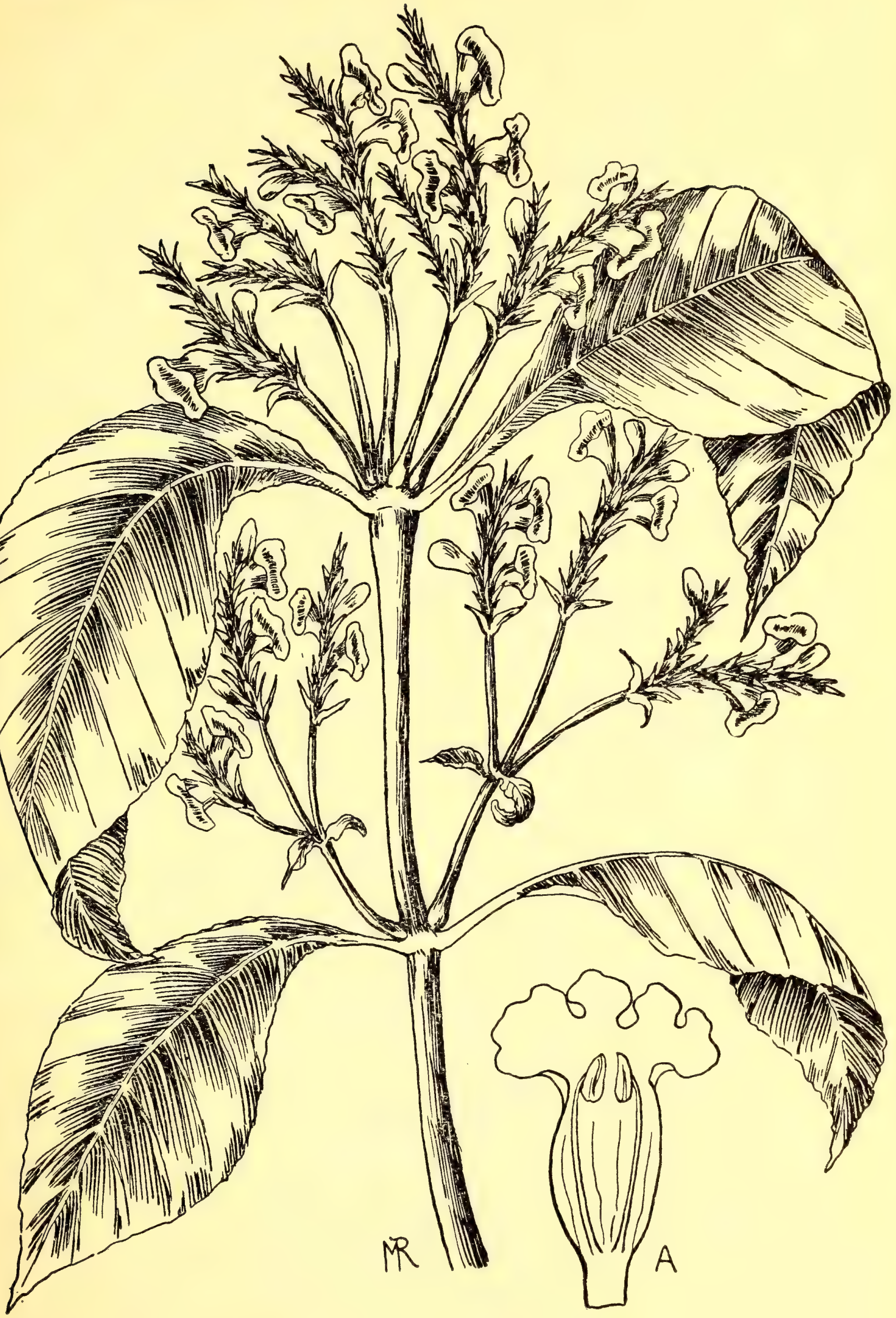
(7) *Strobilanthes Perrottetianus* Nees: (Pl. VII). This was found on the Nilgiris and has been reported from the Anamalais, and was found in 1852 and in 1883 and more lately in 1908 and 1918. Its period may be about ten years but seems irregular.



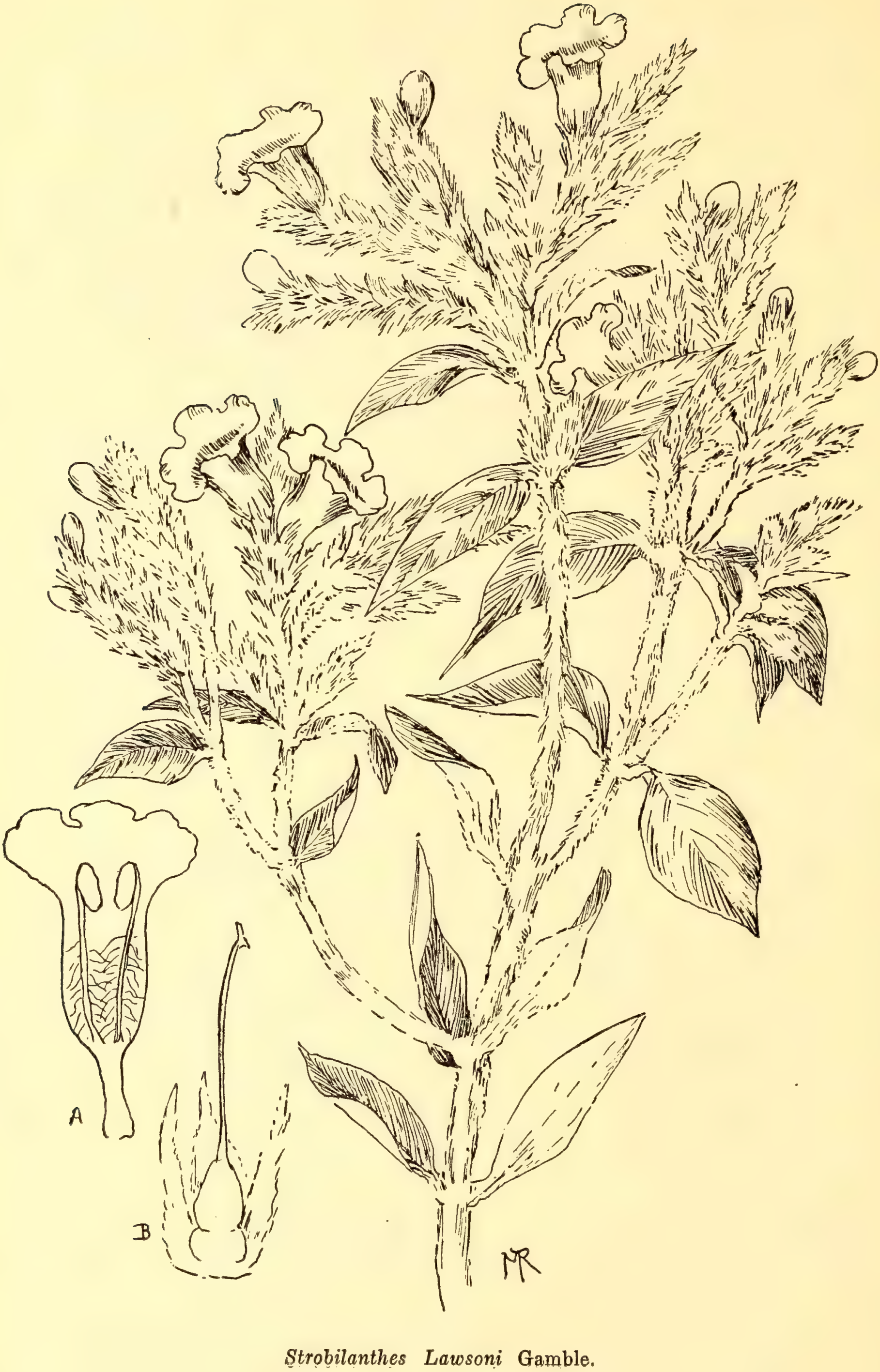
Strobilanthes Kunthianus T. And.



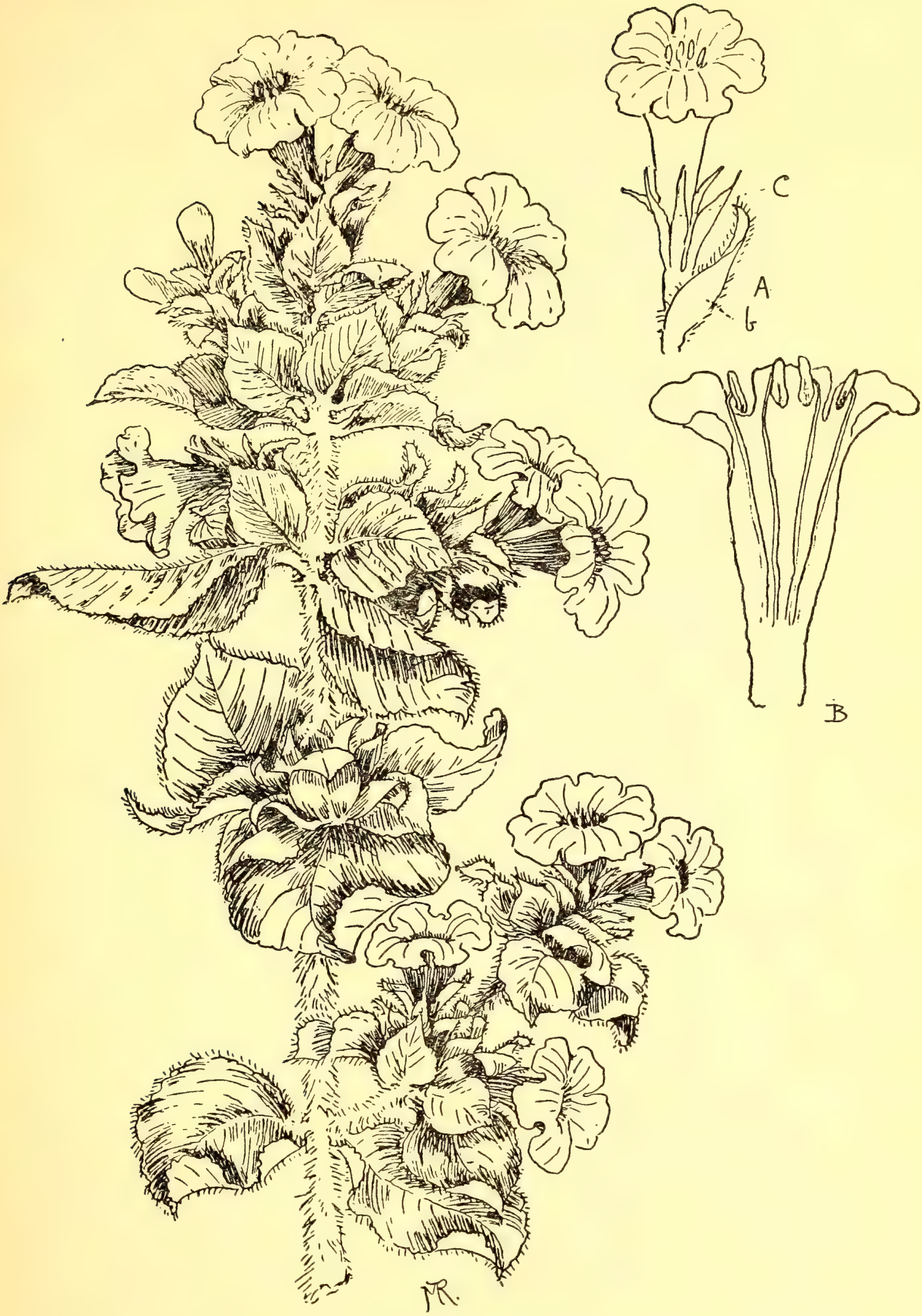
Strobilanthes foliosus T. And. or *S. Zenkerianus* T. And.



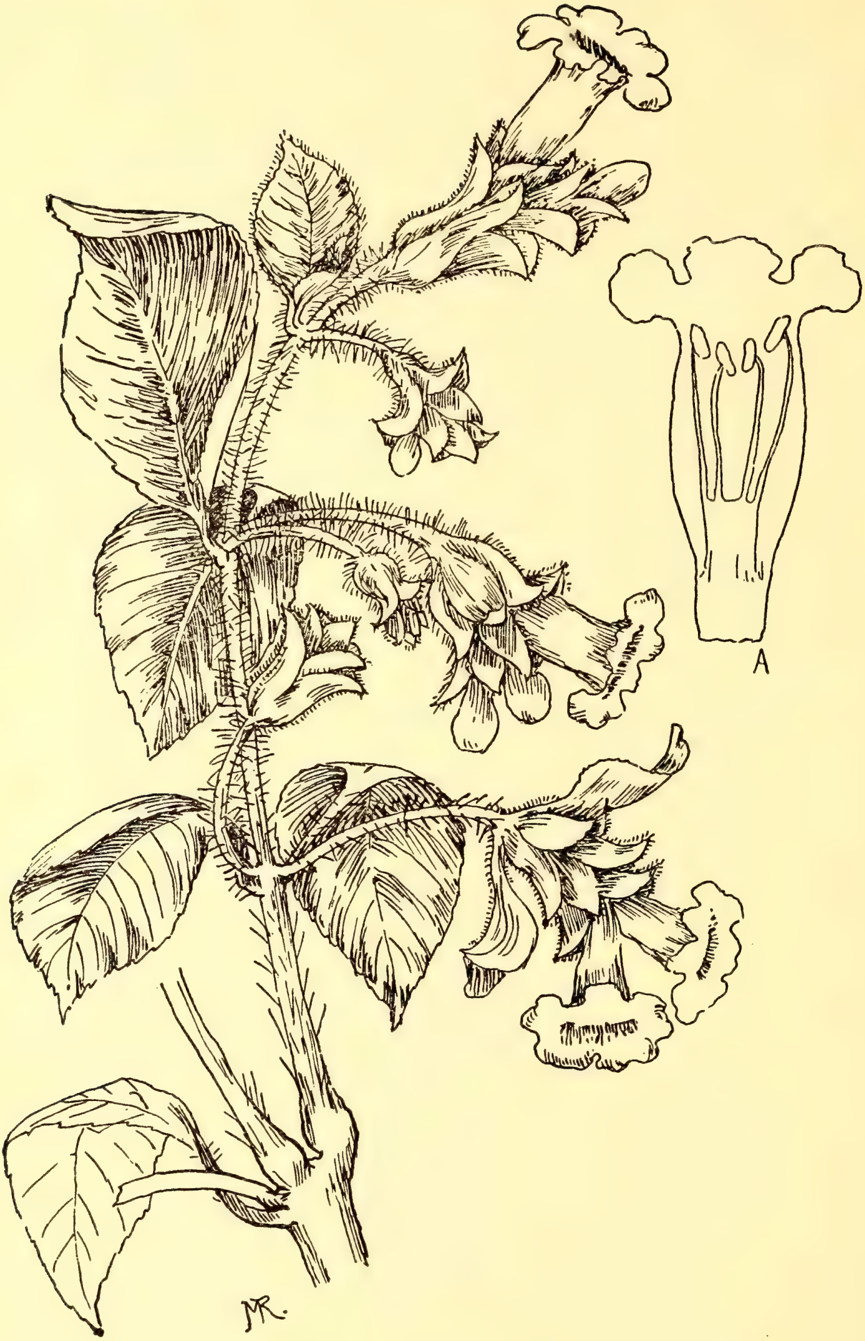
Strobilanthes consanguineus C. B. Clarke.



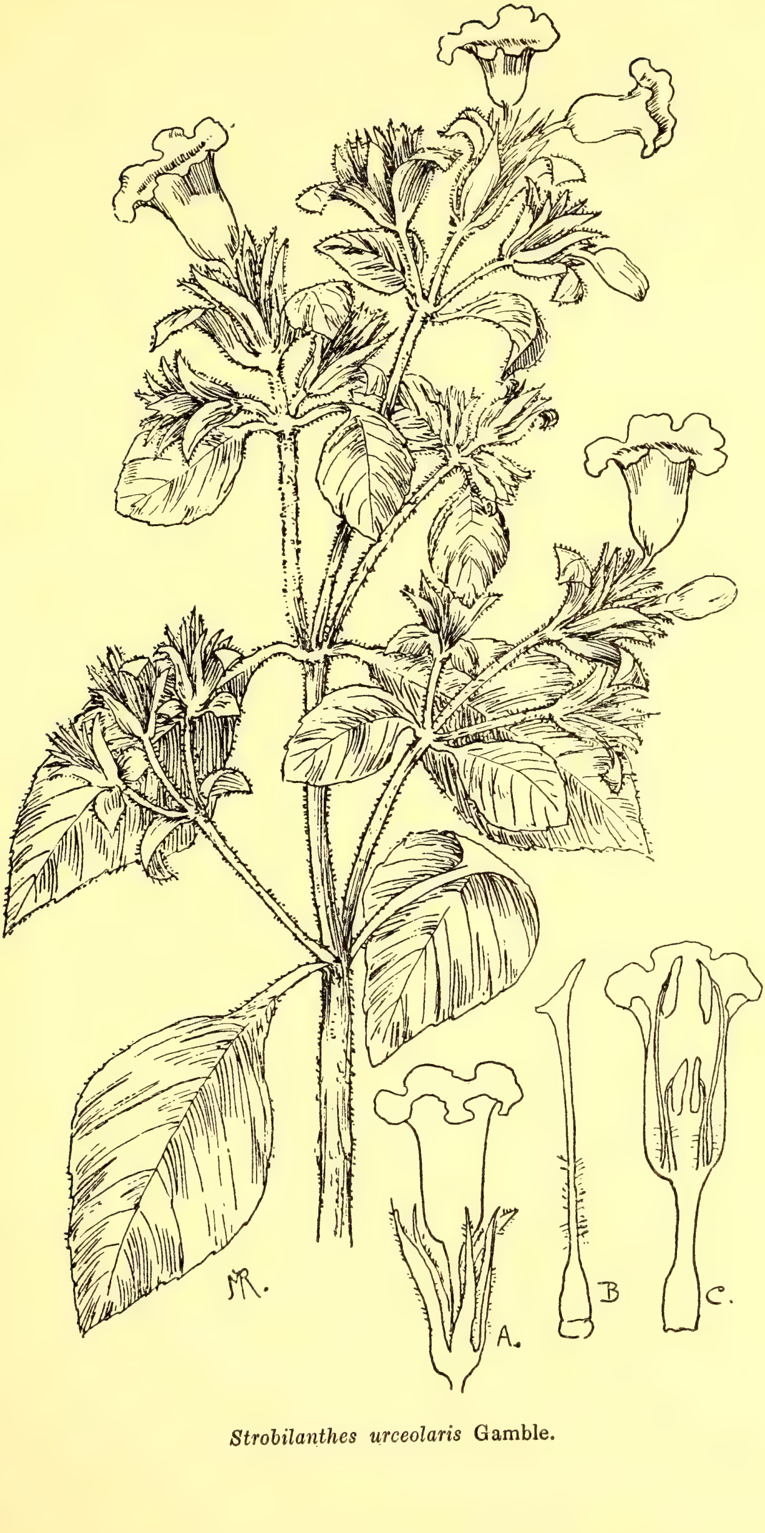
Strobilanthes Lawsoni Gamble.



Strobilanthes Wightianus Nees.



Strobilanthes Perrottetianus Nees.



Strobilanthes urceolaris Gamble.

This grows on the edges of sholas and is also an easily recognised species, being covered on all the younger parts, bracts, leaves and stem with soft dark red hairs. The stems are swollen at the joints. Leaves rather large.

Inflorescence about an inch to two inches long, rather stout, and very conspicuous in the shola by reason of the bracts being rose red; they fade to reddish green as they get older; flower pale lilac, with very short tube; stamens joined in a sheath for lower half, two inner ones slightly shorter.

(8) *Strobilanthes urceolaris* Gamble: (Pl. VIII)· This flowered in November and December on the Pulneys very abundantly by the roadside at about 6,000 ft. and is reported also from the Nilgiris but no dates for its appearance are given by Gamble. A strong aromatic scent was noticed where the shrubs were abundant, the plant being covered with short viscid hairs. Stem slightly swollen at the joints, and reddish.

The inflorescence is short and compact, surrounded by two leafy bracts, and often grows in threes. The corolla pale blue, tube shorter than the bell.

Stamens joined in a sheath at base, two inner shorter than two outer.

News of the flowering of several other species in different localities, chiefly at somewhat lower levels, and in the sholas, has reached me, but as no specimens have been procurable, I am unable to say what species they are. It seems that 1934 has been a good year for the flowering of Strobilanthes.

I should like to express here my grateful thanks to the various friends and correspondents who have helped me by sending me specimens or in identifying them for me. Particularly I should mention Mr. Charles Brown of Coonoor; Mr. Cockburn of Kotagiri; the Rev. Father Münch, S.J., of Shembaganur; Mr. J. Williams of the Anamalais; Mr. R. Morris of the Billigirirangans; Mr. P. V. Mayuranathan, B.A., Government Botanist at the Madras Museum and Dr. T. V. Ramakrishna Iyer, B.A., the Government Entomologist at Coimbatore, to all of whom I am indebted for kind help.

EXPLANATION OF PLATES.

(2) *Strobilanthes Kunthianus* T. And.

A.—Enlarged drawing of flower: (*a*) Stamens; (*b*) Stigma; (*c*) Ovary; (*d*) honey disc.

(3) *Strobilanthes foliosus* T. And. or *Zenkerianus* T. And.

A.—Four outer leaves or leafy bracts.
B.—Inner bracts.
C.—Flower with calyx divided to the middle in *S. foliosus* to the base in *S. Zenkerianus*.
D.—Section of flower of *S. foliosus*.
E.—Stamens of *S. Zenkerianus*.

(4) *Strobilanthes consanguineus* C. B. Clarke.

A.—Section of flower showing stamens.

(5) *Strobilanthes Lawsoni* Gamble.

A.—Section of flower showing stamens.
B.—Ovary on honey disc, and calyx.

(6) *Strobilanthes Wightianus* Nees.

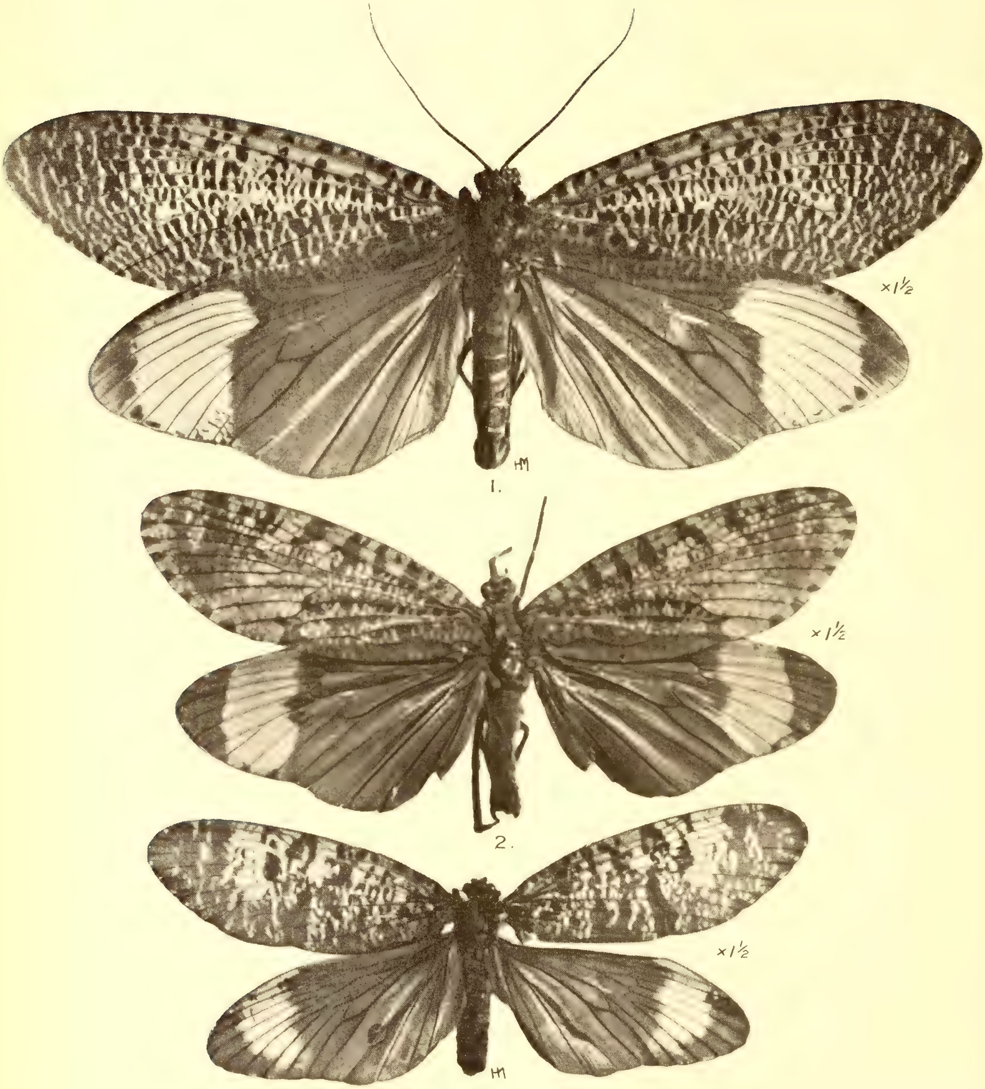
A.—A flower with calyx C and bracts B.
B.—Section showing stamens.

(7) *Strobilanthes Perrottetianus* Nees.

A.—Section showing stamens.

(8) *Strobilanthes urceolaris* Gamble.

A.—Flower with calyx.
B.—Ovary on honey disc.
C.—Section showing stamens.



Photos. A. B. Martinov, & D. E. K.

John Bale Sons & Danielsson, L^td London.

1. EUBASILISSA MCLACHLANI, White, ♀. 2. EUBASILISSA REGINA, McL., ♂.
3. EUBASILISSA TIBETANA, Mart., ♀.

(By kind permission of the Zoological Society of London.)

THE INDIAN CADDIS-FLIES (*TRICHOPTERA*).

BY

MARTIN E. MOSELY, F.B.E.S.

PART III.

(*With thirteen plates*).

(*Continued from page* 629 *of volume* xxxvii).

INAEQUIPALPIA

PHRYGANEIDAE

Burmeister, Handb. Ent., p. 922, 1839.

CHARACTERS OF THE FAMILY.

Antennae stout, generally as long as the anterior wing but sometimes much shorter and, in *Limnocentropus* serrated on the under side in the basal and middle portions; first joint stouter than the others. Ocelli present. Maxillary palpi four jointed in the male, five jointed in the female, similar in structure in both sexes, only slightly pubescent; joints somewhat cylindrical, the basal joint short; labial palpi small, terminal joint generally ovate and spoon shaped. Wings varying in shape in the different genera; usually short and broad and, except in *Limnocentropus*, with rounded apices. In *Agrypnia* the wings are perhaps more elongate and bear a closer resemblance to those of the *Limnophilidae*. In the other genera they are covered with a short dense pubescence; nervures strong; discoidal cell closed in both wings, long and narrow in the anterior and short in the posterior; the first two apical sectors generally arise from its upper margin; median cell wanting; cellula thyridii very elongate; anterior wing with apical forks 1, 2, 3 and 5 in the male (except in *Limnocentropus*) and 1, 2, 3 and 5, sometimes 1, 2, 3, 4 and 5, in the female; posterior wing generally 1, 2, 5 in the male and 1, 2 and 5, sometimes 1, 2, 3 and 5 in the female; anterior wing usually with an additional cross vein uniting the costa and sub-costa; there is however only the one cross vein present in the genera *Limnocentropus* and *Agrypnia*. Legs generally stout and rather short; spurs 2, 4, 4; spines strong and short but sometimes practically absent. The genital appendages of the male vary somewhat according to the genera and species; the inferior appendages are generally strongly developed, two jointed, with the two joints more or less welded together; there is a dorsal plate covering a rather simply constructed penis which is often armed at its apex with a pair of strongly chitinised plates or hooks.

In so far as the records show, the *Phryganeidae* are represented in India by four (perhaps five) genera containing ten (perhaps eleven) species, a total which compares not unfavourably with that of the European fauna. Of these genera, *Oopterygia* has been elected on very slender grounds but a careful search has shown that there is a cross veinlet in *Eubasilissa* between the radius and sub-costa of the anterior wing which does not seem to occur in the former genus. *Eubasilissa* is amply distinguished from *Neuronia* (in which genus the species were formerly placed) by the presence of an additional fork in the anterior wing in the female sex. *Neurocyta* Navás is perhaps an aberrant *Eubasilissa.*

TABLE OF INDIAN GENERA.

1. Fork 1 absent in both wings. LIMNOCENTROPUS Ulmer.
—Fork 1 present in both wings. 2
2. Insects of moderate size, anterior wing about 12 mm. long; only one cross vein between costa and sub-costa. AGRYPNIA Curtis.
—Insects very large, excepting *Oopterygia minor*, anterior wing 20 mm. or more long; an additional cross vein between costa and sub-costa. 3
3. A cross vein connecting the sub-costa and the radius.
EUBASILISSA Martynov.
? NEUROCYTA Navás.
—No cross vein between the sub-costa and radius. OOPTERYGIA Martynov.

Eubasilissa Martynov.

Eubasilissa Martynov — Proc. Zool. Soc. Lond., No. 5, Pt. I, p. 87, 1930.
Regina Martynov — Ann. Mag. Nat. Hist. (9), vol. xiv, p. 215, 1924.
Neuronia Leach partim — Edinburgh Encyc., vol. ix, p. 136, 1815.

Insects very large; ocelli present; anterior wings broad; discoidal cell moderately long; an additional cross vein between the costa and sub-costa and also a cross vein uniting the sub-costa and radius; forks 1, 2, 3 and 5 present in the anterior wings in the male, 1, 2, 3, 4 and 5 in the female; in the posterior, 1, 2 and 5 in the male, 1, 2, 3 and 5 in the female; anterior wing, membrane yellow, sometimes with irregular fuscous bands in the anterior portion and mostly with a fuscous net, partly confluent in the median and apical portions; posterior wing brown or fuscous, sometimes purple with a broad transverse yellow band in the apical half. Inferior appendages ♂ two-jointed, with the two joints welded together, the line of juncture being not easy to define excepting in a balsam preparation.

Genotype: *Eubasilissa regina* McL.

The three known species are easily separated by their wing pattern as may be seen on consulting the figures on the plate. Consequently a table of species is unnecessary here.

I am indebted to Mr. A. B. Martynov for his fine photographs of *E. mclachlani* and *E. tibetana* and to the Zoological Society of London for kind permission to reproduce them from the Proceedings.

Eubasilissa regina McLach. (Pl. I, fig. 2; Pl. II, figs. 4-6).

Holostomis mclachlani White var. *regina* McLach. — Journ., Linn. Soc. Lond. Zool., vol. xi, pp. 103-104, 1871.
Holostomis regina Matsumura — Thous. Ins. Japan, Pl. 12, fig. 1, 1904.
,, ,, Matsumura — Syst. Ent., 1, p. 168, f. 219, 221, 1907.
Neuronia (*Holostomis*) *regina* McLach — Ann. Mag. Nat. Hist., Ser. vi, vol. xiii, p. 421, 1894.
Neuronia regina Hagen — Ver. Zool. bot. Ges. Wien, vol. xxiii, p. 396, 1873.
,, ,, Ulmer — Gen. Insect., fasc. 60a, p. 24, Pl. 29, fig. 3, 1907.
,, ,, Ulmer — Coll. Selys, fasc. 6a, figs. 1-3, Pl. 1, fig. 1, 1907.
,, ,, Ulmer — Deutsch. Ent. Zeit., pp. 239-240, 1908.
,, ,, Ulmer — *op. cit.*, p. 400, 1911.
,, ,, Nakahara — Can. Ent., vol. xlv, p. 323, 1913.
Regina regina Martynov — Ann. Mag. Nat. Hist. (9), vol. xiv, p. 215, 1924.
,, ,, Ulmer — Arch. Naturg., vol. xci, Abt. A, Heft 5, p. 62, 1925.
Eubasilissa regina Martynov — Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 87-88, 110-111, 1930.
,, ,, Ulmer — Pekin Nat. Hist. Bull., vol. vii, p. 147, 1932.
,, ,, McLach. — Iconographia Insectorum Japonicum, p. 1500, 1932.

Anterior wings with a yellow ground heavily mottled with brown markings; these coalesce towards the apex of the wing making a darkish patch in this region; there are eight or nine confluent groups of brown spots along the costal margin of each wing and dark spots along the apical margin at the extremities of the apical sectors. There is an indistinct lightening in colour forming a band across the anterior wing corresponding with and continuing the yellow band of the posterior wing. Posterior wings coloured dark purple brown with a broad transverse yellow band towards the apex extending from the lower to the upper margin and leaving a considerable dark patch at the extreme apex; three or four dark spots on the extreme lower margin of the yellow band.

Length of anterior wing ♂ 34 mm.

Length of anterior wing ♀ 38 mm.

Habitat.—Kulu, Japan, China, Formosa.

Location of the type not indicated but probably in the McLachlan collection.

Eubasilissa regina was considered by McLachlan to be merely a variety of *mclachlani* White. There are, however, ample distinctions in the male genitalia as may be seen on a comparison of the figures of these parts and also distinct differences in the pattern of the wings.

Eubasilissa mclachlani White (Pl. I, fig. 1; Pl. III, figs. 7-10; Pl. IV, figs. 11-12).

Holostomis m'Lachlani White — Zoologist, vol. xx, p. 7860, 1862.
,, ,, White — Proc. Ent. Soc. Lond., Ser. 3, vol. i, p. 26, 1862.
,, ,, Hagen — Ver. Zool. bot. Ges. Wien, vol. xiv, p. 820, 1864.
Holostomis maclachlani McLach. Journ. Linn. Soc. Lond. Zool., vol. xi, p. 103, 1871.
Phryganea maclachlani McLach. — Trans. Ent. Soc. Lond., Ser. 3, vol. v, pp. 249-250, Pl. xvii, fig. 1, ♀, 1866.
Neuronia maclachlani Hagen — Ver. Zool. bot. Ges. Wien, vol. xxiii, p. 395, 1873.
,, ,, Betten — Rec. Ind. Mus., vol. iii, p. 242, 1909.
Neuronia mclachlani Ulmer — Notes Leyd. Mus., vol. xxviii, p. 103, 1906.
,, ,, Ulmer — Gen. Insect., fasc. 60a, p. 24, 1907.
,, ,, Ulmer — Coll. Selys, fasc. 6a, p. 6, 1907.
Regina mclachlani Martynov. — Ann. Mag. Nat. Hist. (9), vol. xiv, p. 215, 1924.
Eubasilissa mclachlani Martynov Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 87, 111, Pl. 1, fig. 1, 1930.

Anterior wings reddish orange, thickly and uniformly reticulated with blackish fuscous markings which do not coalesce to make definite blotches as in *regina;* there are two conspicuous whitish spots, one in the *cellula thyridii* and the other in the sixth apical cell. In *regina* these spots are far more indistinctly indicated. Posterior wings purple brown, a very broad orange coloured band occupying almost the entire apical third as in *regina;* the dark fuscous patch at the apex of the wing small as compared with that of *regina* and the dark spots on the lower margin of the orange band less conspicuous; there are seven or eight faintly indicated spots on the upper margin of the band as well.

There are marked differences in the male genitalia between the two species, special attention being directed to the strongly-formed tongue which arises at the centre of the terminal ventral segment (seen from behind) and meets a corresponding tongue descending from the lower penis cover to meet it. This feature is absent in *regina*.

Length of anterior wing ♂ 31 mm.
Length of anterior wing ♀ 40 mm.

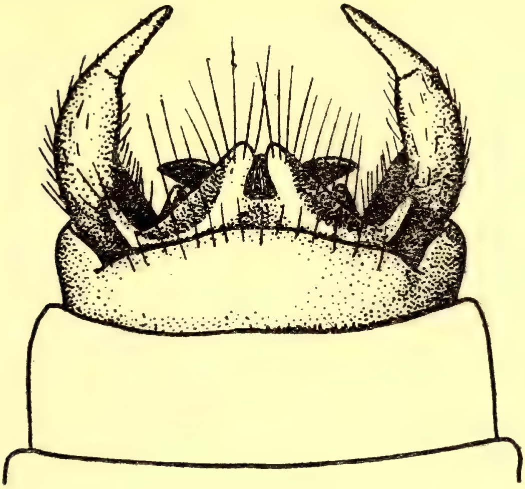


Fig. 4.

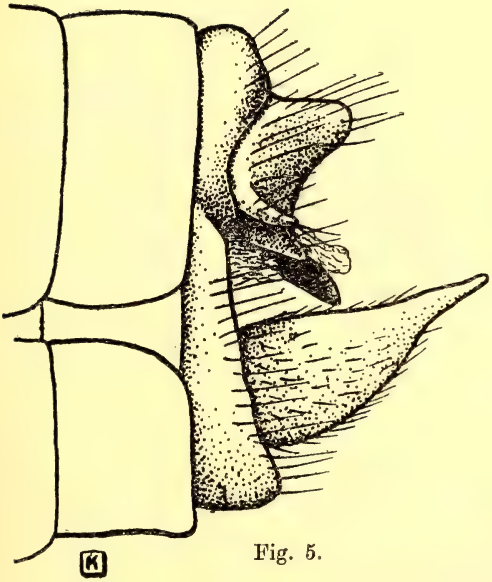


Fig. 5.

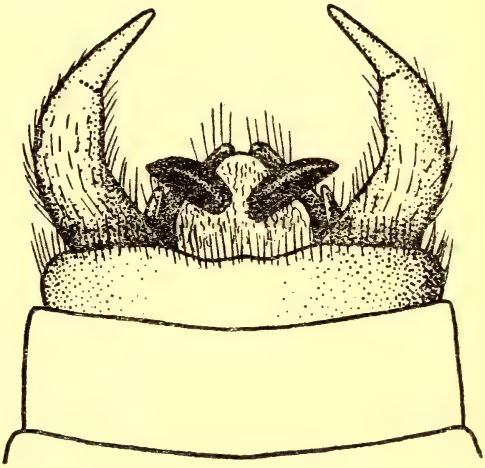


Fig. 6.

Eubasilissa regina, McL., ♂.

Fig.—4, genitalia dorsal; 5, lateral; 6, ventral.

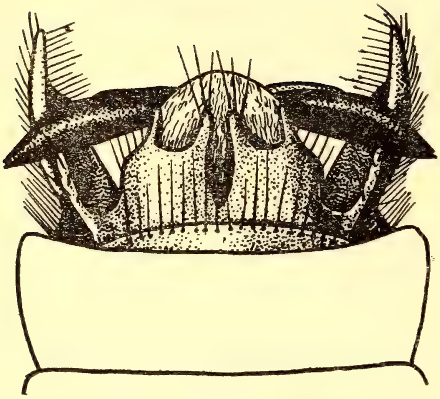


Fig. 7.

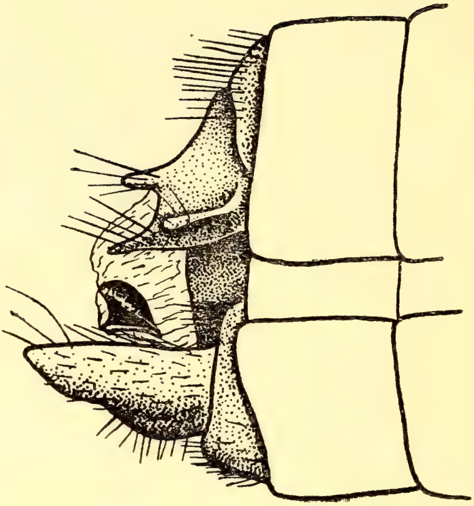


Fig. 8.

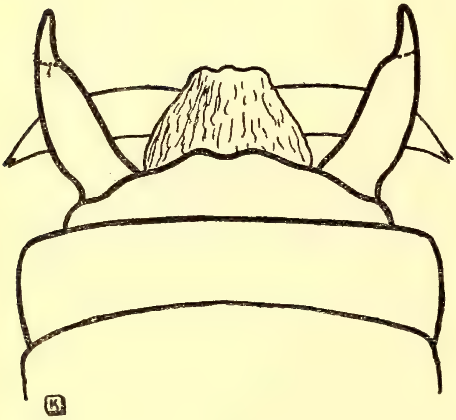


Fig. 9.

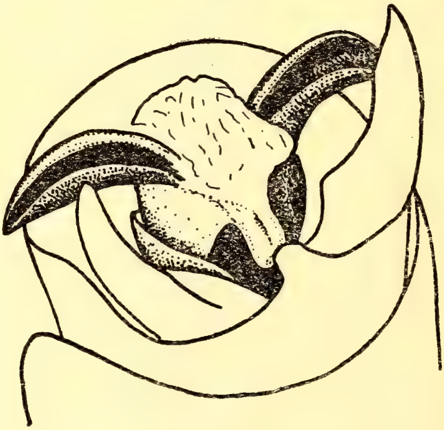


Fig. 10.

Eubasilissa mclachlani White, ♂.

Fig.—7, genitalia dorsal; 8, lateral; 9, ventral; 10, penis and inferior appendages obliquely from beneath.

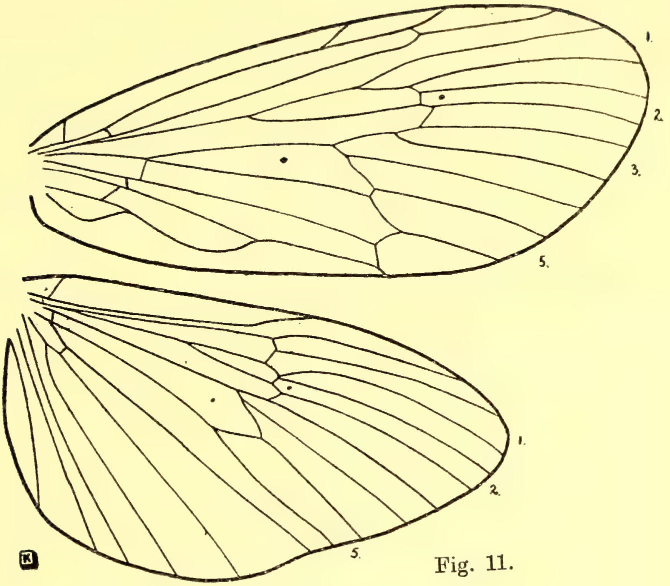


Fig. 11.

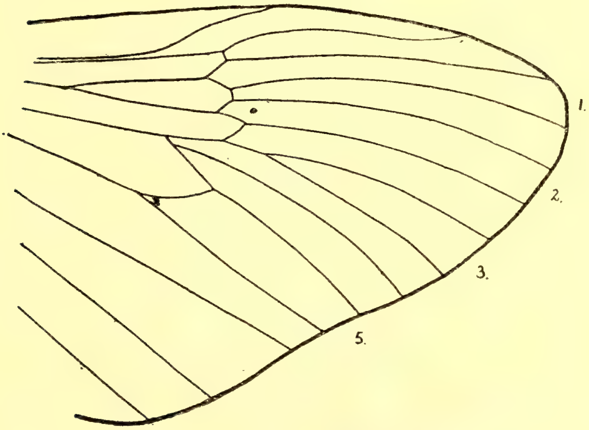


Fig. 12.

Eubasilissa maclachlani White.

Fig.—11, wings ♂; 12, apex of posterior wing ♀.

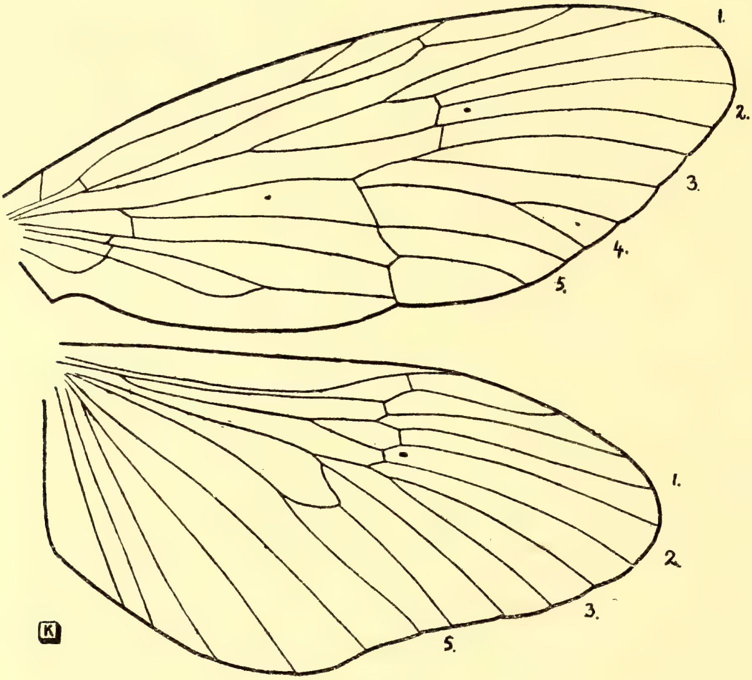

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Fig. 13.

Eubasilissa tibetana Mart., ♀.
Fig. 13.—Wings.

Habitat.—Darjiling, Assam, Kulu.
Type ♀ in the collection of the British Museum.

Eubasilissa tibetana Martynov (Pl. I, fig. 3; Pl. V, fig. 13).

Eubasilissa tibetana Martynov, Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 88-111, Pl. 1, fig. 2, 1930.

Pattern of the wings very similar to that of *regina*. Dark blotches along the costal margin of the anterior wing scarcely evident; apical and lower margins of the wing darkly-clouded; a clear patch extending down from the costal margin to rather more than half-way. In the posterior wing, the yellowish transverse band is smaller than in either of the other two species and does not extend as far as the lower margin of the wing; ♂ unknown.

Length of anterior wing ♀ 32 mm.

Habitat.—Sikkim, Tibet.

Type and paratypes ♀ in the collection of the British Museum: paratype ♀ in the Zoological Museum, Leningrad.

The absence of the strongly indicated blotches along the costal margin of the anterior wing and the more confined area of the yellow band of the posterior wing suffice to separate this species from *regina* which is moreover considerably larger. The wing pattern is abundantly distinct from that of *mclachlani*. It is to be hoped that the male will be discovered in order that some idea of the genitalia may be obtained.

Oopterygia Martynov.

Oopterygia Martynov, Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 88-89, 1930.

Anterior wings very broad, almost oval, darkish-yellow with uniform pale yellow reticulation or orange with brown spots; an additional cross-vein between the costa and sub-costa; no cross-vein between the sub-costa and radius; posterior wings broad, either uniformly reticulated as in the anterior or else dark fuscous with a broad yellow band occupying the distal area as in *Eubasilissa*. Superior appendages absent, inferior appendages rather long, distinctly two jointed, second joint short, sub-oval or capitate, welded to the first. Ocelli present, spurs probably 2, 4, 4, but both posterior legs are missing in the unique genotype, and the spurs are not mentioned in the description of *O. asiatica* Betten.

Genotype: *Oopterygia brunnea* Martynov.

Three species in this genus are known, *brunnea* Martynov, *asiatica* Betten, *minor* sp. n. described herein, *asiatica* being distinguished by the yellow band across the dark ground-colour of the posterior wing. They may be separated from *Eubasilissa* species by the rather more ovate shape of the wings and the absence of the cross vein between sub-costa and radius.

The additional cross vein between the costa and sub-costa in the anterior wing is omitted in Martynov's description of *brunnea*, but a re-examination of the type has shown that it is present. It is indicated by Betten in his figure of *asiatica*.

Oopterygia brunnea Martynov (Pl. VI, figs. 14-17).

Oopterygia brunnea Martynov, Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 89-91, 111, figs. 33-36, 1930.

Head and thorax brown, antennae dark reddish-yellow with indistinct annulations, palpi brownish. Anterior wing broad, egg-shaped, rounded at the apex; ground-colour uniformly pale greyish-testaceous or somewhat brownish, densely and uniformly irrorated with indistinct round pale confluent spots; fringes very short, pale yellowish; membrane finely granulose clothed with short brownish hairs; nervures testaceous. Legs reddish-brown with short yellow hairs, femora somewhat lighter in colour, spines black, spurs 2, 4 (4?) reddish-yellow.

The single species has lost both posterior legs but there can be little doubt that the spurs would number 4 in accordance with the Family characters.

Length of anterior wing ♂ 22 mm.

Habitat.—Tibet, Yatung, 4,500 ft.

Type ♂ in the collection of the British Museum.

Oopterygia asiatica Betten (Pl. VII, figs. 18-19).

Neuronia asiatica Betten — Rec. Ind. Mus., vol. iii, Pt. III, p. 242, Pl. xviii, figs. 15-16, 1909.

? *Neuronia asiatica* Martynov — Ann. Mag. Nat. Hist. (9), vol. xiv, p. 216, 1924.

Oopterygia asiatica Martynov — Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 89-91, 11, 1930.

Head and thorax dark brown; eyes black, ocelli yellow. Anterior wings orange with brown spots, the largest spots along the costa and apical margins covering the tips of the veins, a particularly large spot on the tip of the Sc.; there is an irregular brown band following the line of the anastomosis from the first branching of the media to the tip of the anal veins. The posterior wing has the basal two-thirds dark-brown, the distal third is yellow. There is an interrupted apical band of brown, the brown spots being on and along the tips of the veins. The abnormality of venation shown in the anal veins of the posterior wing occurs in both wings of the specimen.

Length of body ♂ 15 mm.; expanse 41 mm.

Habitat.—Sibsagar, Assam.

Type ♂ in the collection of the Indian Museum, Calcutta.

I am unacquainted with this fine insect and so give Betten's description as published in the records of the Indian Museum. His figures of neuration and genitalia indicate a close affinity to Martynov's *O. brunnea.*

Oopterygia minor sp. n. (Pl. VIII, figs. 20-23).

Head very dark fuscous, oculi black; antennae almost entirely wanting in the unique type, basal joint fuscous, palpi fuscous;

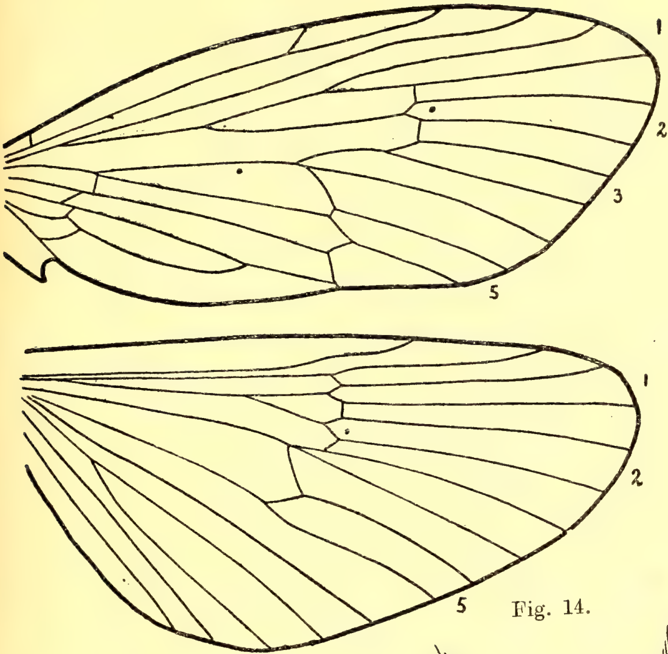


Fig. 14.

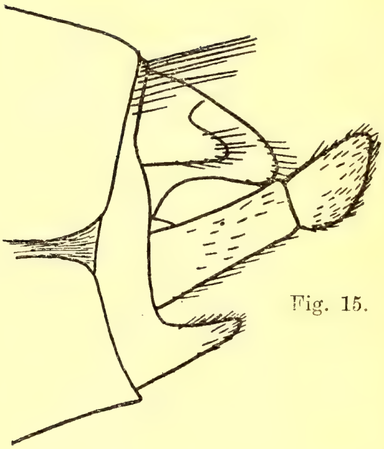


Fig. 15.

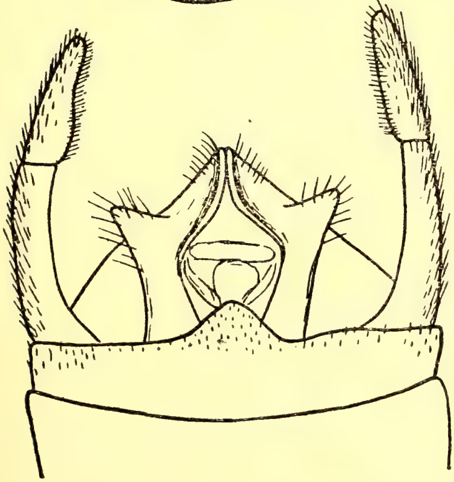


Fig. 16.

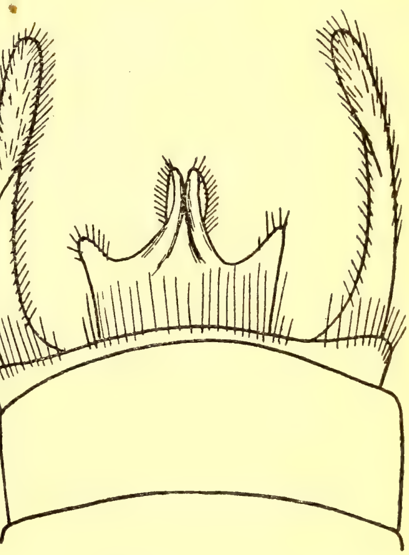


Fig. 17.

Oopterygia brunnea Mart., ♂.

Fig.—14, wings; 15, genitalia lateral; 16, ventral; 17, dorsal (*genitalia after Martynov*).

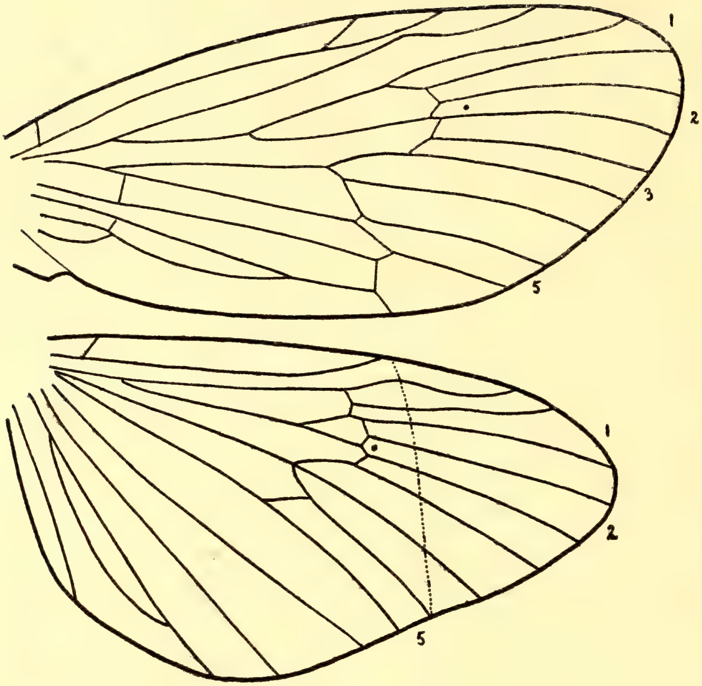


Fig. 18.

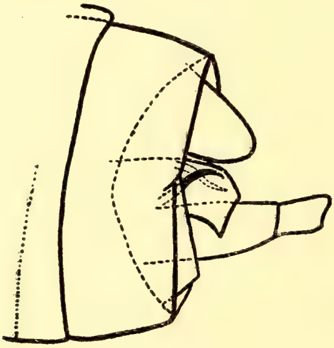


Fig. 19.

Oopterygia asiatica Betten, ♂.

Fig.—18, wings; 19, genitalia lateral (*after Betten*).

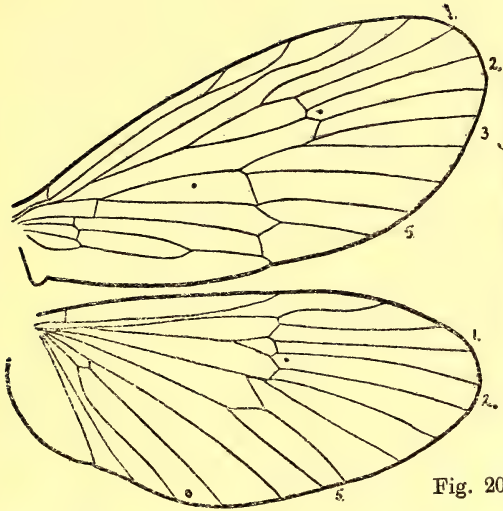


Fig. 20.

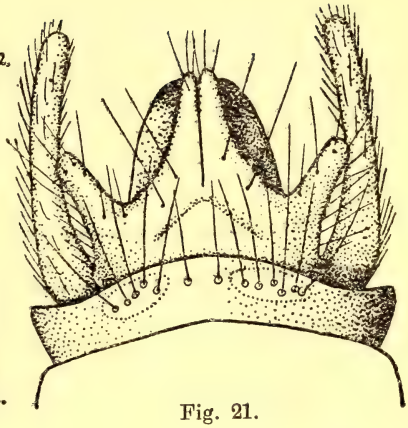


Fig. 21.

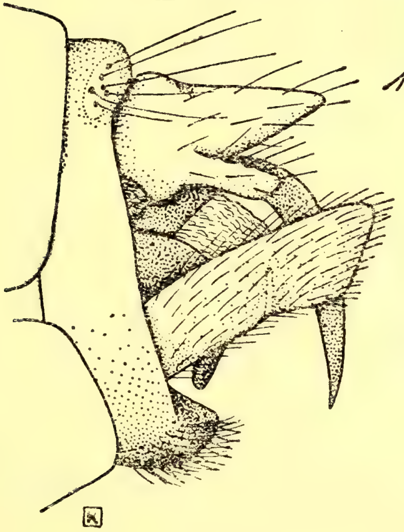


Fig. 22.

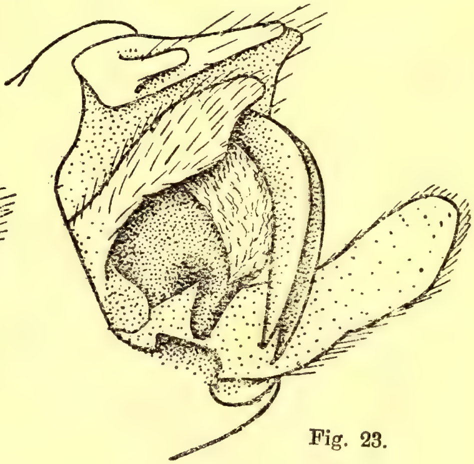


Fig. 23.

Oopterygia minor sp. n., ♂.

Fig.—20, wings; 21, genitalia dorsal; 22, lateral; 23, ventral, oblique, slightly from behind.

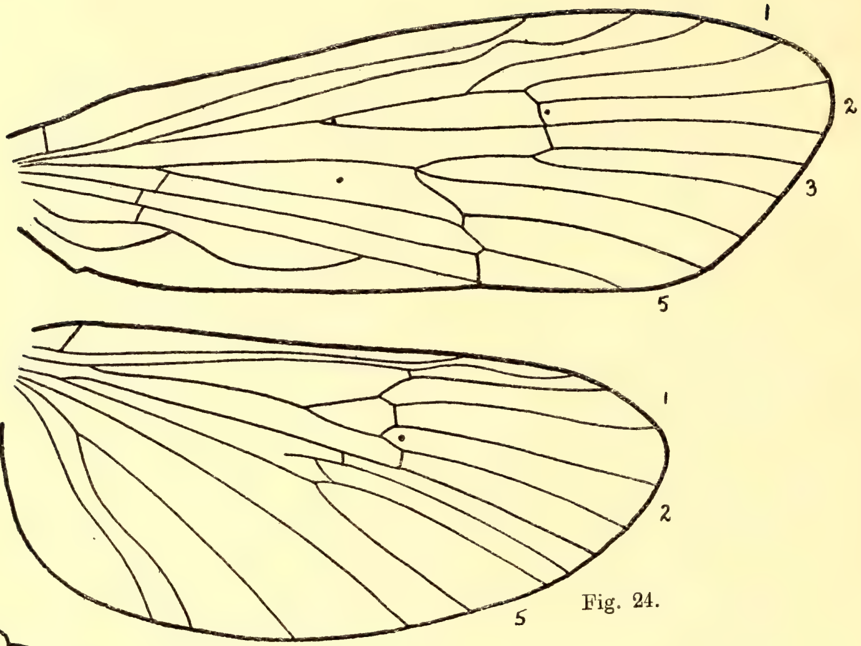


Fig. 24.

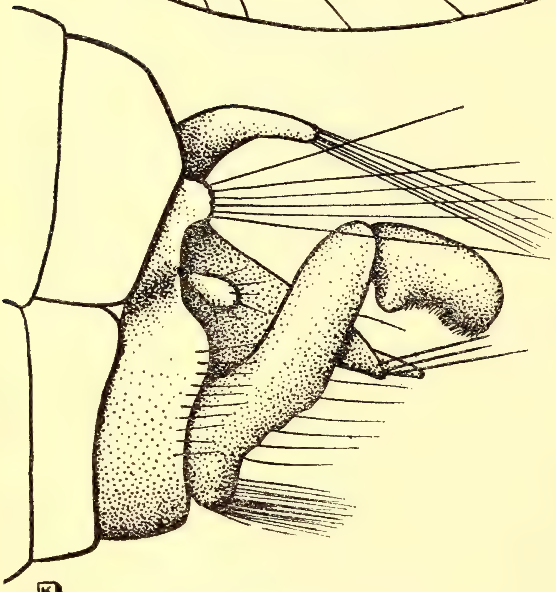


Fig. 25.

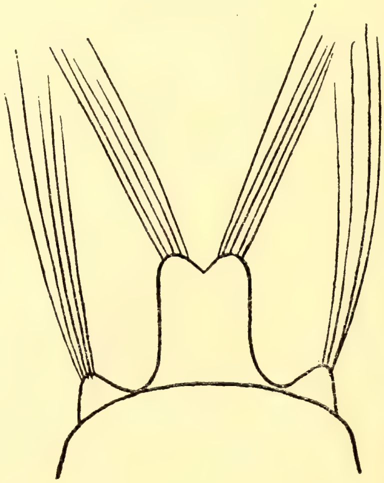


Fig. 26.

Agrypnia picta Kol. var. **tibetana** Mart., ♂.
Fig.—24, wings; 25, genitalia lateral; 26, dorsal plate.

legs mostly wanting, spurs pale and thin; wings short and rounded, anterior fuscous irrorated with pale spots.

Genitalia ♂. Margin of the ninth dorsal segment from above evenly rounded with two conspicuous light coloured warts bearing long hairs; beyond the dorsal margin projects a trifid plate, central projection excised with a deep slit; there are two large penis-sheaths strongly chitinised and curving downwards; penis membranous; lower penis cover in the form of a black, strongly chitinised hook arising from a broad base with the apex very slightly excised, and directed downwards towards a raised strongly chitinised blunt nodule situated at the centre of the margin of the ninth ventral segment and with its surface covered with short dark setae; inferior appendages parallel-sided with a short terminal joint fused to the basal joint, apex from the side, obliquely truncate.

Length of anterior wing ♂ 12 mm.

N.-E. Burma, Kambaiti, 7,000 ft., 13-22-6-1934, R. Malaise.

Type ♂ in the Stockholm Museum.

This is the smallest of the known Indian *Phryganeidae*.

Neurocyta Navás.

Neurocyta Navás, Mem. Ac. Cienc. Art. Barc., vol. xii, No. 13, p. 240, 1916.

Navás sates that the genus is similar to *Neuronia*, differing mainly in the presence of an additional cross vein dividing the discoidal cell of the posterior wing into two portions.

The genus *Neuronia* not being as yet recorded in India, the comparison should be made with Martynov's genus *Eubasilissa*.

Genotype: *Neurocyta arenata Navás*.

Neurocyta arenata Navás.

Neurocyta arenata Navás, Mem. Ac. Cienc. Art. Barc., vol. xii, No. 13, pp. 240-241, fig. 1, 1916.

Figures of the ♂ wing are given showing an aberrant discoidal cell in the posterior wing. No figures of the genitalia are given. I have not seen the single male example which is in Senor Navás's collection in the Barcelona Museum, but the curator Senor Espanol, has kindly sent me a photograph of the type.

Length of anterior wing ♂ 24.5 mm.

Habitat.—Darjiling, 1910.

Agrypnia Curtis.

Agrypnia Curtis — Brit. Ent., p. 540, 1835.
" Hagen — Ver. Zool. bot. Ges. Wien, vol. xxiii, p. 430, 1873.
" McLachlan — Rev. and Syn. Trich., p. 28, 1874.
Phrophryganea (partim) Martynov Ann. Mus. Acad. Imp. Sci. Peters., vol. xiv, p. 259, 1909.
" Martynov Ann. Mag. Nat. Hist. (9), vol. xiv, pp. 210-211, 1924.

Anterior wing with very slight pubescence, rather narrow, apex obliquely truncate, only one nervure, at the base, between the costa and sub-costa; forks 1, 2, 3 and 5 present in the anterior wing of the ♂, 1, 2, 3, 4 and 5 in the ♀; forks 1, 2 and 5 in the posterior wing in both sexes. Ocelli present. Spurs 2, 4, 4. The form of the insect is much more elongate than in the other genera of the *Phryganeidae* and the species might be easily but mistakenly placed amongst the *Limnophilidae*. The neuration shows a tendency to aberration, particularly in the posterior wing.

Genotype: *Agrypnia pagetana* Curt.

Only one species has been recorded as belonging to the Indian fauna namely *A. picta* in Tibet and Martynov considers that the Tibetan form should rank as a variety.

Agrypnia picta Kol. var. **tibetana** Martynov (Pl. IX, figs. 24-26).

Prophryganea picta Martynov — Ann. Mus. Acad. Imp. Sci. Peters., vol. xiv, p. 259, 1909.
Prophryganea picta var. *tibetana* Martynov — Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 91-111, 1930.
Agrypina picta var. *tibetana* Ulmer Pekin Nat. Hist. Bull., vol. vii, p. 150, 1932-33.

Anterior wings more or less brownish as the brown spots are very indistinct and diffuse. In the male genitalia the dorsal plate is rather longer than in European typical examples of *picta* and the second joint of the inferior appendage is somewhat longer and not so dilated.

Length of anterior wing ♂ 14 mm.
Length of anterior wing ♀ 15 mm.

Habitat.—Tibet.

Type ♂ and paratype ♀ in the collection of the British Museum.

Limnocentropus Ulmer.

Limnocentropus Ulmer — Coll. Selys, fasc. 6a, pp. 13-14, figs. 21-23, 1907.
,, Ulmer — Gen. Insect., fasc. 60a, p. 28, 1907.
,, Martynov — Ann. Mag. Nat. Hist. (9), vol. xiv, p. 213, 1924.

Head broad and short, ocelli present and conspicuous; antennae somewhat shorter than the anterior wing, rather slender, the basal half serrated on its under side. Maxillary palpi stout; in the ♀, first joint very short, second long, third still longer, fourth about as long as the second, fifth slightly shorter than the third; in the ♂, they correspond to the second, third, fourth and fifth of the ♀. In the labial palpi, the third joint is not oval as in many of the *Phryganeidae*. Wings ovate, broad, clothed with thick brown pubescence; apices in the male blunter than in the

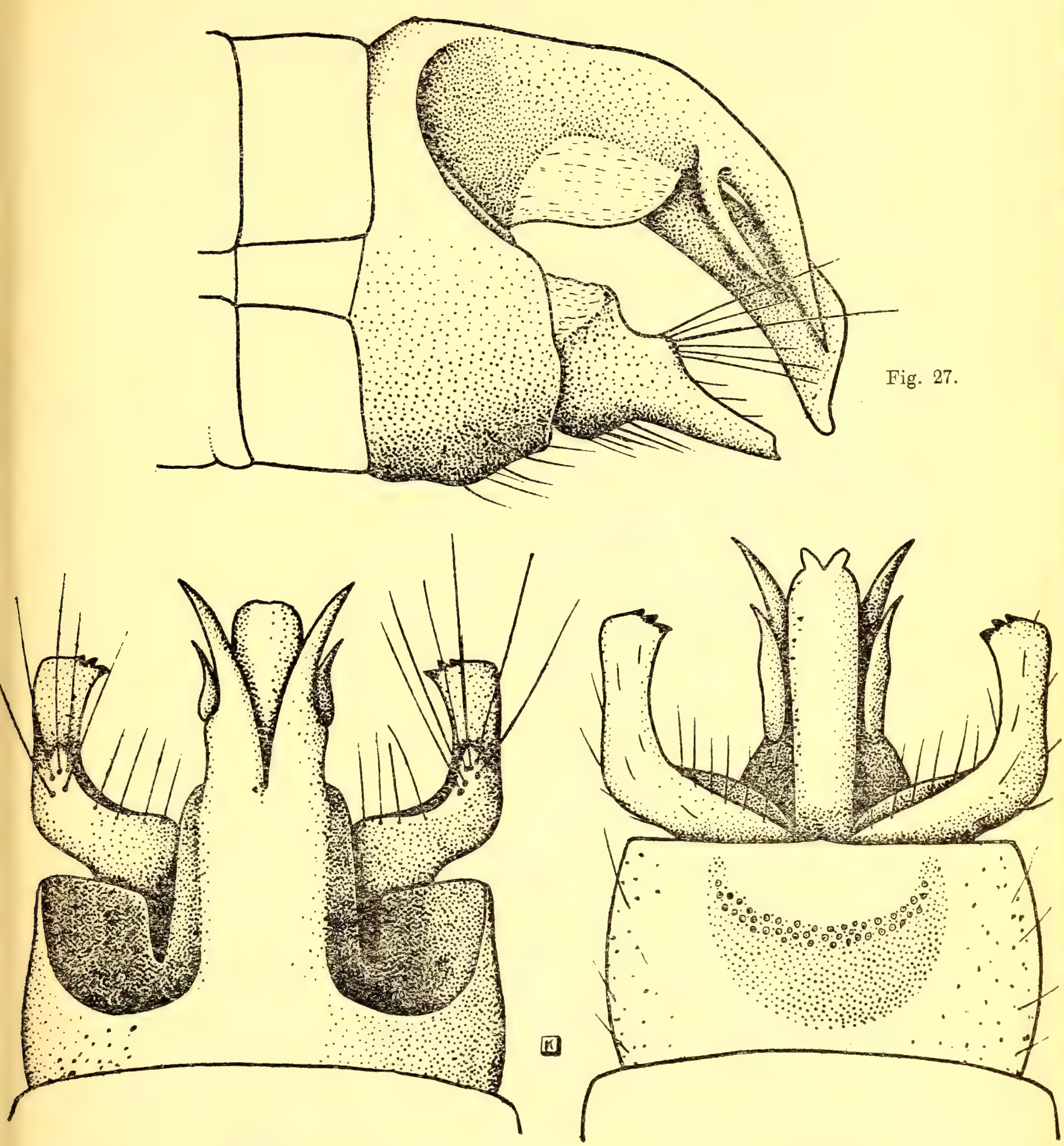


Fig. 27.

Fig. 28.

Fig. 29.

Limnocentropus insolitus Ulm., ♂.
Fig.—27, genitalia lateral; 28, dorsal; 29, ventral.

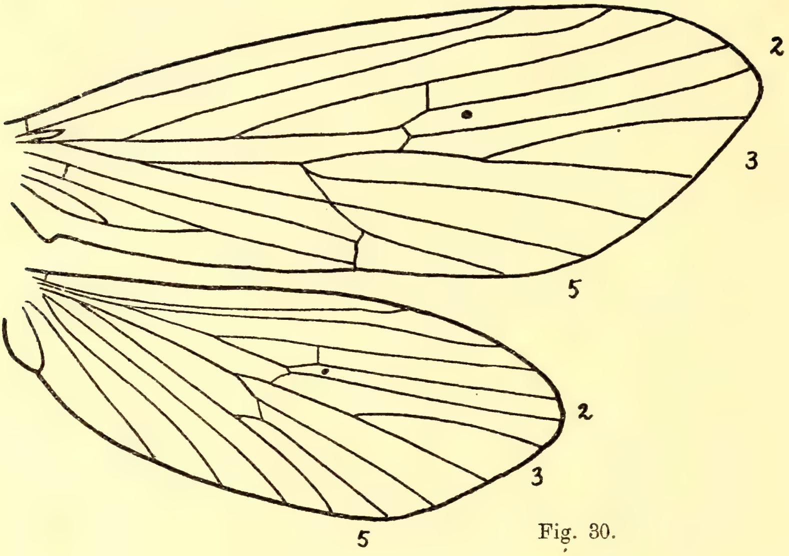


Fig. 30.

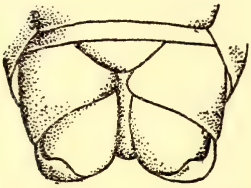


Fig. 31.

Limnocentropus insolitus Ulm., ♀.

Fig.—30, wings; 31, genitalia dorsal (*after Ulmer*).

female; neuration alike in both sexes; forks 2, 3 and 5 present in both wings, fork 3 with a foot-stalk; discoidal cell closed, smaller in the posterior than in the anterior. Legs with spurs 2, 4, 4; spurs of equal length and densely clothed, like the legs, with adpressed hairs, median leg of ♀ not dilated. Genitalia male with a well developed down curved dorsal plate and simple curved inferior appendages, elbowed towards the centre; penis simple. Seventh sternite produced at its centre in a shallow lobe.

Genotype.—*Limnocentropus insolitus* Ulmer.

Limnocentropus insolitus Ulmer (Pl. X, figs. 27-29; Pl. XI, figs. 30-31).

Limnocentropus	*insolitus*	Ulmer —	Coll. Selys, fasc. 6a, pp. 13-14, figs. 21-23, 1907.
,,	,,	Ulmer —	Gen. Insect., fasc. 60a, p. 28, 1907.
,,	,,	Ulmer —	Notes Leyd. Mus., vol. xxix, p. 2, figs. 1-2, 1907.
,,	,,	Nakahara	Can. Entom., vol. xlv, No. 10, p. 327, 1913.
,,	,,	Martynov	Ann. Mag. Nat. Hist. (9), vol. xiv, p. 213, 1924.
,,	,,	Ulmer —	Arch. Naturg., vol. xci, Abt. A, Heft. 5, p. 63, 1925.
,,	,,	Martynov	Proc. Zool. Soc. Lond., No. 5, Pt. I, pp. 91, 110, 111, 1930.
,,	,,	Ulmer —	Pekin Nat. Hist. Bull., vol. vii, p. 148, 1932-33.

The whole insect is of a deep smoky chocolate-brown; head, thorax and abdomen black and in general appearance not differing in any marked respect from *fletcheri* and Martynov's subspecies *himalayanus*.

Genitalia ♂.—Eighth tergite straight; ninth tergite is produced at its centre in a very long dorsal process, the apical half cleft in two slender diverging forks with acute spine like apices; from the side, the process is very broad towards the base tapering to an acute point and, at about the centre there arises on each side, from the lower lateral margin directed backward, a short curved spine, which may be seen from above, projecting on each side of the central forks; below this process is the penis which is long, curving downwards with an obliquely truncated apex; from beneath the apex is seen to be divided to make a small membranous fork; the inferior appendages from the side narrowing to acute apices with slight blunt projections towards the base on the upper margins furnished with tufts of long hairs; from above the appendages are broader at the base and are strongly elbowed, apices truncate and serrate.

Length of anterior wing ♂ 12 mm.

The above description has been drawn up from the Japanese example in the Berlin Museum kindly lent for the purpose by

Dr. H. Bischoff. The type of the species is a ♀ example, also from Japan in the De Selys collection in Brussels.

Ulmer states that he has seen an example from Darjiling in the Paris Museum but the specimen cannot now be found. In his list of *Chinese Trichoptera*, he gives the distribution as China, Japan, Darjiling and Sikkim but *insolitus* may well have been confused with the new species *fletcheri* described below and I have some doubt as to whether it should rightfully be included in the Indian fauna.

Limnocentropus insolitus Ulmer, subsp. **himalayanus** Martynov (Pl. XII, figs. 32-33).

Limnocentropus insolitus Ulmer, Proc. Zool. Soc. Lond., No. 5,
subsp. *himalayanus* Martynov — Pt. I, p. 91, 1930.
Ulmer — Pekin Nat. Hist. Bull., vol. vii, p. 148, 1932-33.

Head much destroyed in the single example known, reddish-brown, basal joint of the antennae reddish, remainder wanting. Wings dark brown clothed with golden brown hairs.

Genitalia ♀.—Terminal dorsal segment strongly produced from above, and lying close on each side of the produced portion are two long chitinised plates joined at their apices by a membrane.

♂ unknown.

Length of anterior wing ♀ 13 mm.

This species may possibly be the ♀ of *L. fletcheri* sp. n.

Sikkim, Tsung-tang, 6,000 ft., 24, iv. 1924 (Mt. Everest Expedition), (Major R. W. G. Hingston).

Type ♀ in the British Museum collection.

Limnocentropus fletcheri sp. n. (Pl. XIII, figs. 34-37).

Head black, clothed with tawny hairs; antennae light ochraceous, strongly annulated with dark fuscous and distinctly serrate beneath nearly to the apex; maxillary palpi very dark fuscous, nearly black with groups of very short light coloured hairs at the apex of each joint. Wings uniformly dark brown clothed with short golden pubescence, rather less pointed at the apices than those of *insolitus*. Legs yellowish.

Genitalia ♂.—The margin of the eighth dorsal segment is widely excised with the centre of the excision somewhat convex; the ninth segment, the genital capsule, is produced at the centre of its dorsal margin in a long narrow yellow bifurcate dorsal plate with a narrow central upper lobe whose rounded apex projects slightly over the excision between the two forks whose apices are also rounded; side pieces of the ninth segment blunt, apices slightly excised as seen from the side, upper margin blackened and carrying a few stout hairs; penis short, stout and membranous, apex furnished with two short down turned hooks; inferior appendages from beneath, each very broad at its base with a wide rectangular excision at the centre of its inner margin so that it is abruptly narrowed in its apical half; apices from beneath directed slightly

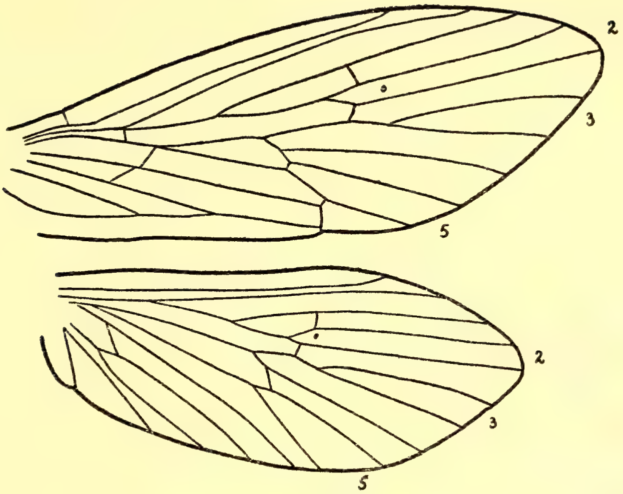


Fig. 32.

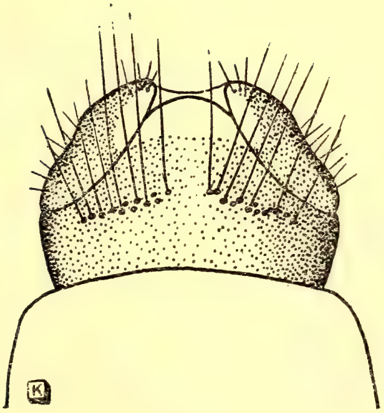


Fig. 33.

Limnocentropus insolitus Ulm. subsp. **himalayanus** Mart., ♀.
Fig.—32, wings; 33, genitalia dorsal.

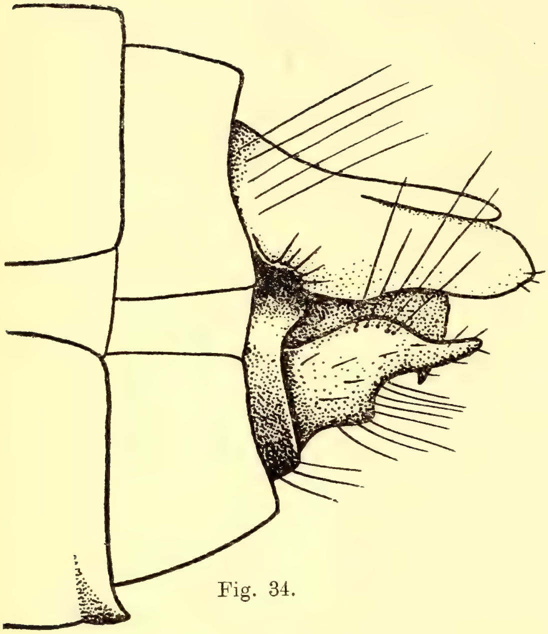


Fig. 34.

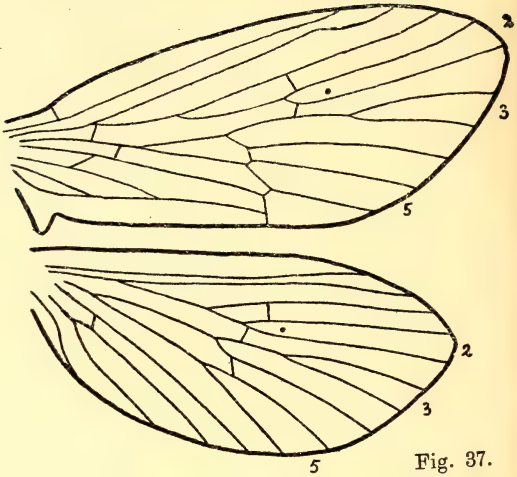


Fig. 37.

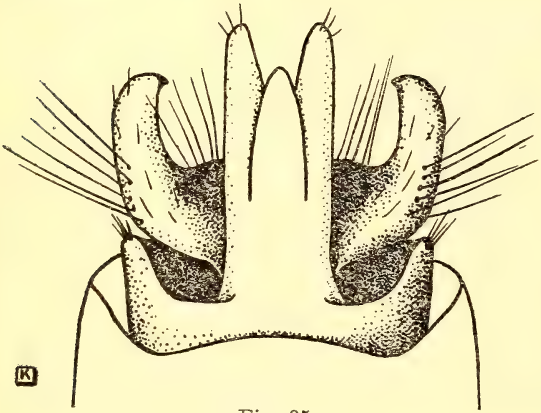


Fig. 35.

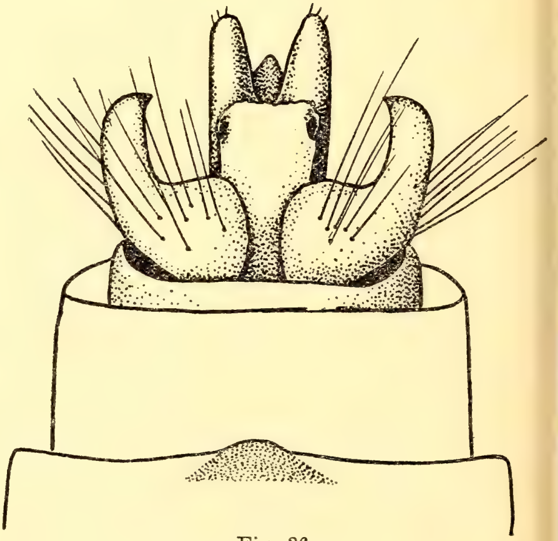


Fig. 36.

Limnocentropus fletcheri sp. n. ♂.
Fig.—34, genitalia lateral; 35, dorsal; 36, ventral; 37, wings.

inward; from the side there is a projecting angle on the lower margin towards the base; the upper margin is convex and the appendage terminates in a slender finger. The margin of the seventh ventral segment is produced at its centre to make a short wide process which is strongly pigmented so as to give an exaggerated idea of its size.

Length of anterior wing ♂ 10 mm.

Habitat.—Sikkim. 5,000 ft., 18-30 April, 1922.

Type ♂ in the collection of the British Museum.

I have pleasure in dedicating this species to Fleet-Paymaster T. Bainbrigge Fletcher, whose extensive collection of *Indian Trichoptera* forms the basis of this series of articles.

(To be continued).

A DESCRIPTION OF THE NOTODONTID MOTH *DUDUSA NOBILIS* WALKER, AND ITS EARLY STAGES.

(*With a Plate showing figs.* 1, 2, *photographs of male and female imagines respectively; fig.* 3, *the larva; and fig.* 4, *the pupa).*

BY

T. R. BELL, I.F.S. (Retd.).

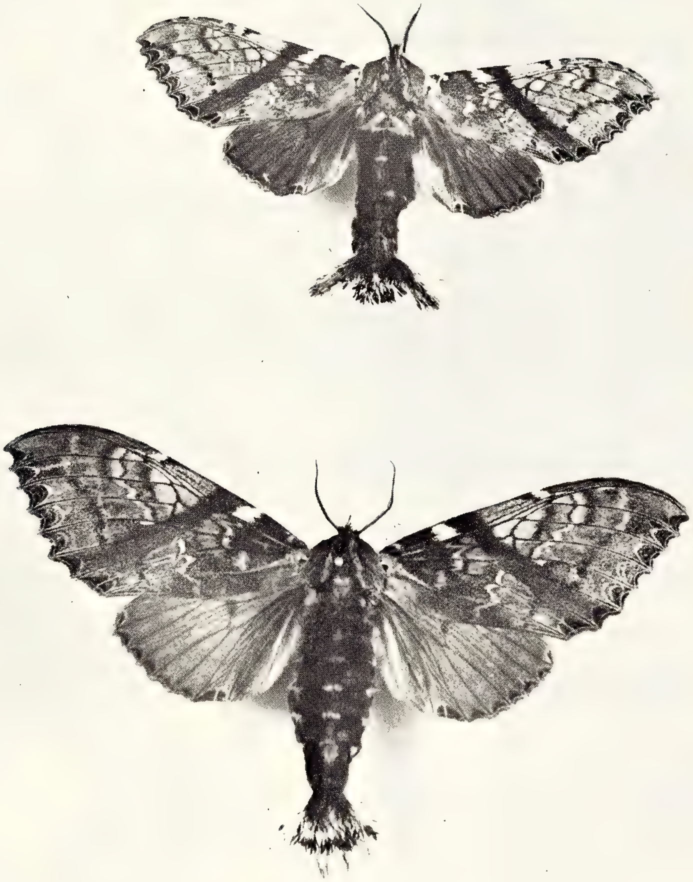
(*With two plates*).

Imago.—Female antennae and frons of head dark-brown; thorax ochreous buff; mesothorax with a pair of dark-brown tufts; abdomen with long and large tuft of bob-ended hairs from end segment, brown with medial and lateral rows of pale spots. *Upper side*: Forewing ochreous, outer marginal area ashy-brown; termen crenulate with dark, pale-edged lunules in the crenulations; a dark, submarginal and pale postmedial, crenulated line; a dark-brown fascia from the middle of costa to outer angle; a triangular, brown patch on inner margin and at base of wing; two white patches on costa. Hindwing smoky brown with darker brown marginal lunules. *Under side*: Both wings pale brown with the marginal areas pale buff on which there are dark lunules; traces of crenulate median and submarginal lines; a dark spot at outer angle of cell of hindwing. Thorax underneath dark brown; of abdomen ochreous with brown markings. Legs brown; hind leg with a white spot at end of femur and tibia. Male similar to female; two white patches at costa with an additional white patch at base of forewing. Hindwing darker than in female. *Exp.* 99 mm. for female, 77 mm. for male.

The above was described from 20-year old specimens. In fresh examples the dorsum of abdomen is deep black as well as its terminal large tuft; the upper side of hindwings is also darker in the new specimens.

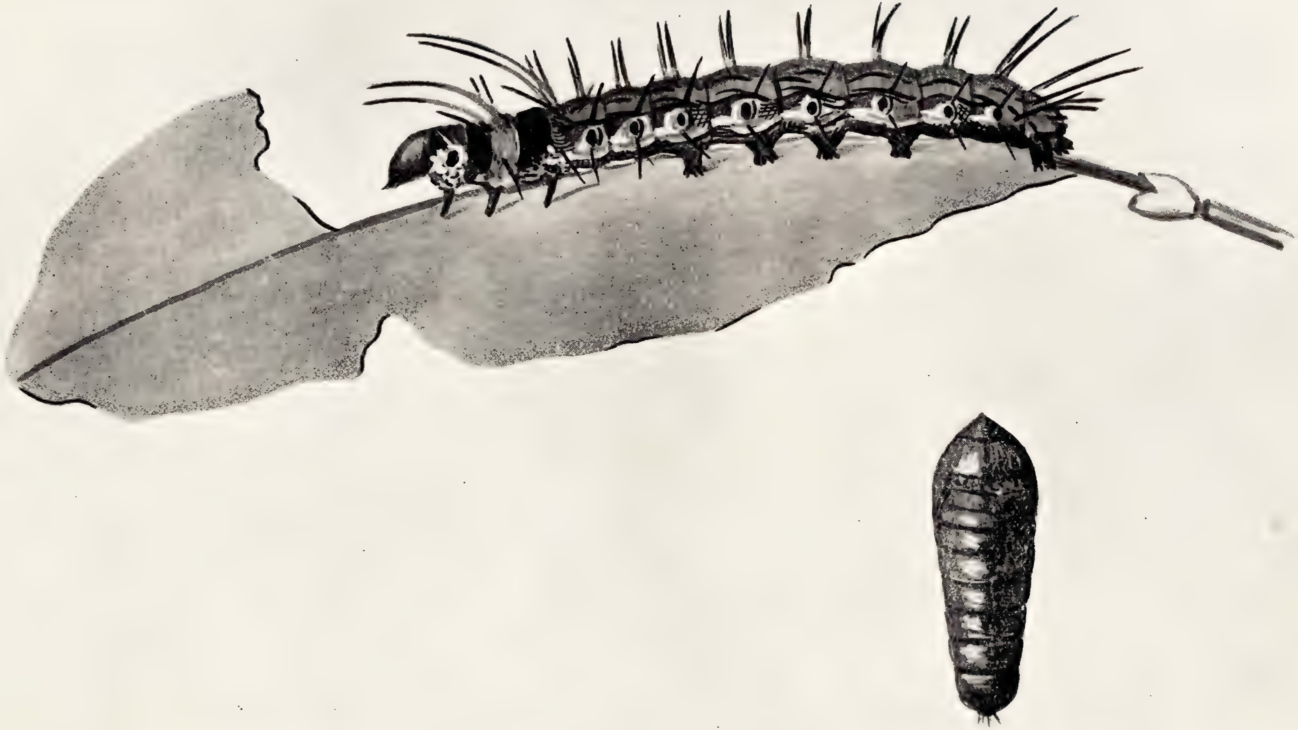
The moth sits at rest with the wings tightly folded against the body and the abdomen sometimes considerably upturned. It is impatient of light and flies after dusk. It is certainly not attracted by artificial light.

Larva.—Cylindrical in shape, slightly thickest in the middle, the segments well distinguished; anal segment rather convex, short, nearly semi-circular; 13 large and with its dorsal line slightly more inclined than that of 14, at an angle of about 45° to the longitudinal axis of the body; all prolegs and anal claspers developed in the normal way, their shanks rather cylindrical, brownish-red, ankles the same, the feet short; true legs stout, red. *Head* large, 8 mm. in diameter for the maximum breadth of body of 10 mm.; the surface minutely granulate, closely so, except on face where it is more sparsely so, shining, the hairs very minute; the colour, of a sealing-wax red colour, tinged brown; it is hardly bilobed but there is a slightly depressed, dorsal line; true clypeus one-third height of face, triangular, apex rounded, a slight constriction towards middle of sides, false clypeus half height of face, apex acute, broadening out from base upwards; labrum and ligula shining-black, thick and chitinized, the latter somewhat longer than former which is one-third length of true clypeus, the labrum with a deep-impressed, dorsal line and depressed, lateral areas near hinder margin; the ligula semi-circular with a deep, triangular sinus, its surface uneven; mandibles orange-brown, the ends broadly black, the cutting-edges entire; basal joint of antenna black, third dark-rusty, both shining; eyes arranged: the uppermost 2 diagonally placed behind the three 3, 4, 6 which are in a straight line, numbers 1, 2 close together, 3, 4 twice as far apart with 3 this distance from 2, number 6 twice as far below 4 as 4 is from 3, number 5 behind, forming an equilateral triangle with 4 and 6; all these eyes small, the line joining centres of 1 and 2 being really at right angles to that joining centres of 3, 4, 6. *Surface*: smooth and dull with the following stout, long, simple, yellow spines with black ends, that are perpendicular to the surface, some of them being slightly curved: one subdorsal, one supra- and one sub-spiracular to each segment 3 to 13; two small red-brown ones under the subspiracular ones of 5 and 6, one above the other and a single one in the same position on the other segments (on base of proleg or true leg or otherwise); a curved, dorso-lateral, extra spine on segments 3, 4, 13; segment 12 has an extra minute, subdorsal one near the hinder margin; 14 has six short, stout, red-brown, round hinder margin as well as a subdorsal-central one; segment 2 has a comparatively short, black, supra-spiracular spine and a very short, sub-spiracular one. *Spiracles* large, broadly oval, dull-black, flush, about



The 'Yellow Peril' Moth (*Dudusa nobilis* Wlk.).
(Male above, female below.)

PLATE II.



The larva and pupa of the 'Yellow Peril' (*Dudusa nobilis*, Wlk.).

one-seventh of a segment-length long and the width is more than half the length. *Colour* of body is clear canary-yellow; a brown-red, long collar dorsally to segment 2 with the anal flap, prolegs and claspers and a patch in front of and above each spiracle the same; spiracular region streaked shortly and longitudinally fairly closely with thin, black lines; a white, irregular, somewhat interrupted, sub-spiracular band that is about as broad as a spiracle is, this band wanting on 3, 4, 13 to 14; the whole of the anterior halves of dorsal somites 3 and 4 are velvety-black whence there is a thin and black, dorsal line to the hinder margin of 12; another short, also thin, black line from a dorsolateral point on front of each segment 4 to 12 to just below the base of the subdorsal spine and another on the same segments from just above that spine to hinder margin, as well as a third, twice gently waved, laterally bordering the lined spiracular area; all the subdorsal and lateral spines, except those of 3 and 4, are canary-yellow with the end half or third black; the supra- and sub-spiracular spines are wholly black; the rest are brown-red. Subdorsal spines of 10, 11 are slightly smaller than the rest. Length 85 mm.; breadth 10 mm.; the head 8 mm. in diameter; length of dorso-lateral spines of 3 and 4: 14 mm.; of subdorsals of all segments: 7 mm.; of supra- and sub-spiracular spines: 6 mm.; of others: only a few millimetres.

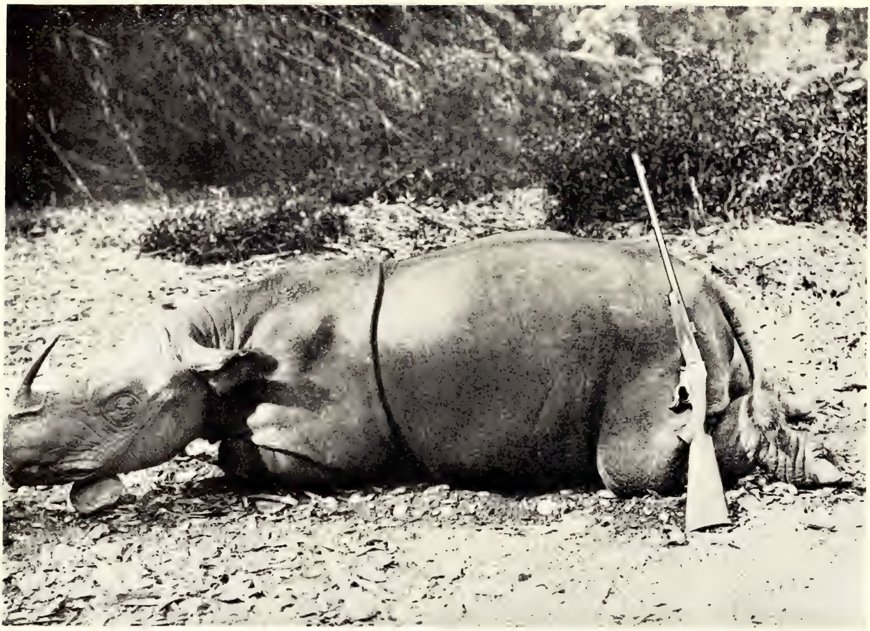
Pupa.—Somewhat club-shaped but very broadly, stoutly so, the greatest breadth from shoulders back to 7 whence the diameter decreases gradually to anal end which is hemispherical, the base of hemisphere quite 7 mm. in diameter compared to a maximum body-breadth of 15 mm.; segment 14 is a very flat plate or cap ending the abdominal cone with a row of six small cones, simple and without hooks, transversely across its middle; 13 has a row along hinder margin of some twenty small, laterally-flattened teeth, the two end ones being the smallest; these teeth are like short-oblong cogs standing perpendicular to the surface and are on the front margin of 14 also, tight up against the corresponding ones of hinder margin of 13 and are somewhat round-topped, with the tops grey-velvety; the row of 6 cones of 14 are really well in front of the apex of the cap; the clasper scars show as a lump ventrally of abdomen end, with a longitudinal, central, depressed line; segment 14 ventrally in the female pupa is prolonged triangularly forwards through 13 and the hinder margin of 12 with a small, longitudinally-elongate pit touching the apex of the prolongation; 12 is just under 3 mm. long while 13 is 1 mm.; segment 11 is 4 mm. with the front margin longly and evenly bevilled to the common margin of 10-11, its surface in no way distinguishable from the remainder of the segment-surface; 10 is 5 mm., its hinder margin (the same as those of 8 and 9) more steeply bevilled than front margin of 11, the surface of the bevil rather closely granulate-rough and abruptly limited frontal from rest of segment; $7=8=9$ in length and the front bevils of 9, 10 are identical with that of 11; segment $6=12$, about 3 mm.; segment 5 is just about half 6 and equal to 4; the thorax is 7 mm. $=5+6+7$ together, its hinder margin coarsely, smoothly beaded, the beads 18 in number, each side decreasing in size from a subdorsal, large bead and this hinder margin of thorax is an extremely slightly curved line meeting the wings in a very broadly-rounded angle of 120°, its front margin straight, curved forwards on each side slightly to spiracles of 2, its dorsal line very distinctly and coarsely low-carinated, inclined to the longitudinal axis of the body at 75° in front third, this inclination gradually decreasing backwards over 4, 5, 6 to become parallel to axis in 7; segment 2 is 3.5 mm. long, convex both ways, the dorsal line carinated like the thorax, the front margin straight, the whole segment twice as wide as long, the margins meeting in points at spiracles; and it is in a plane at right angles to the axis, quite perpendicular that is. *Head* with vertex in the same plane as 2, narrow between the bases of antennae, the frons nearly ventral, a prominent, narrow strip between eyes, transversely rounded and very deeply divided throughout its length by seven cross-lines; the mandibular pieces are prominent-uneven, rather large between the eyes which are corrugated on front half, rather smooth behind, the two halves divided by a linear, nearly straight, depressed crescent-line; the clypeus is a trapeze-shaped piece with the frons-prominence running on to its proximal half; proboscis reaches middle of wings, the fore legs ending a little beyond one-third length of wings, the mid legs reach two-thirds length of wings; antennae end between fore legs and end of proboscis; the ends of hind legs are visible as a triangular, medially-divided piece between the triangularly-separated apices of wings.

Surface of wings is shining, the legs, proboscis and its halves and antennae are limited by depressed lines, the veins are just indicated and it is superficially and rather coarsely lined like cracked lacquer; the head as described for eyes and frons; 2 smooth except for dorsal carination; thorax transversely, somewhat-irregularly corrugated; abdomen rather like the thorax but superficially pitted besides, front and hinder margins superficially longitudinally parallel-lined for a short distance, segment 8 with front margin much more prominently similarly lined; segments very distinct, abdominal segments 8 to 11 even constricted at margins; no sign of larval hairs but the spines have left representing scars. *Spiracles* of segment 2 indicated by the hinder margin of 2 being wide-curvedly but shallowly emarginate in front of the slit, the thorax having a corresponding segment of a circle, twice as long as broad on front margin to fit into the emargination of 2, both these very slightly thickened, both thickenings rugose, the transverse length of the arrangement about equal to one of the remaining spiracles which are all very large, velvety fawn-coloured, parallel-sided, round-ended ovals, fully four times as long as broad, the length equalling about half a segment-length (leaving the bevilled margins of 8 to 11 out) long, the margins of the fawn-colour bounded by a thin-raised border that is the colour of pupa and there is an obscure surrounding, flush oval space broader than the spiracle but the same length upon which the whole is placed and a central slit to the fawn-coloured part. *Colour* of pupa nearly black, the surface not very shining. Length 42 mm.; breadth 15 mm. at middle; 9 mm. at 12.

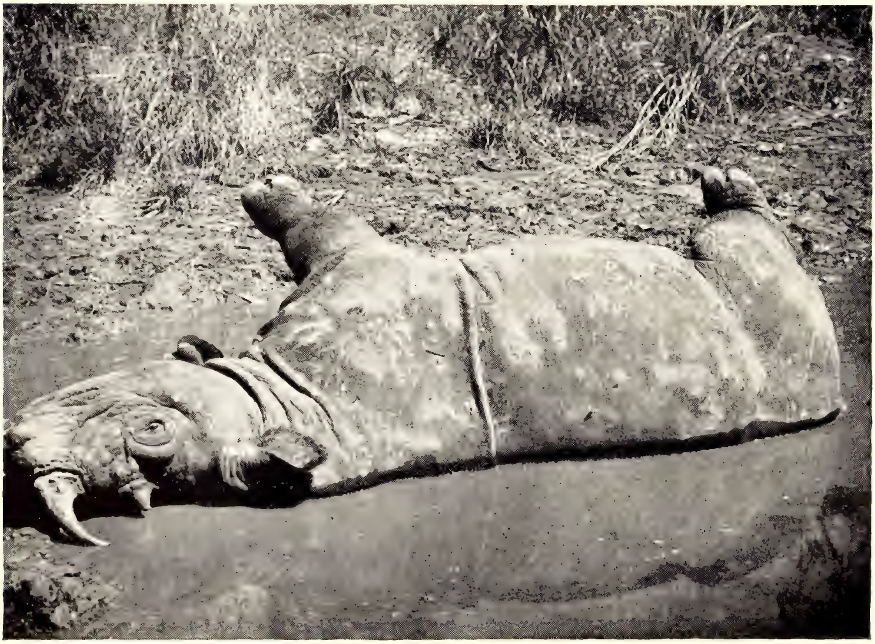
The spiracles, of 2 sometimes show velvet-brown, longly oval in between the roughened surfaces; segments 4, 5 are sometimes obscurely carinated in dorsal line; the pupa is always somewhat swollen in 6, 7 and 8; the ventral line is practically straight.

Habits.—The larvae are generally found high up on trees of Sadagi (*Schleichera trijuga*, Willd.) in the big jungles of the line of the Western Ghats in N. Kanara District; and more particularly in evergreen areas. They lie on the undersides of leaves, eating the mature ones, hiding in the thicker bunches. I have discovered the majority of them after the first introduction, by the presence of droppings on road-surfaces but, finally, did a day or two of systematic hunting and got a satisfactory number. The first specimen was brought in many years ago by one of my servants who fetched it down with a stone from the very top of a high tree, a really good shot. Needless to say he was more or less a boy. The caterpillar was badly damaged and of course died; but the introduction had been effective and all the more exciting because the larva is of a very unusual type and a fine thing to look at. We christened it the Yellow Peril. The larva descends to the ground to pupate well below the surface of the soil in an earthen cell, smoothed on the inside but unlined with silk. The pupa is not fixed in any way inside. Five larvae went down in October and the first imago emerged in the month of June of the following year. Larvae are to be found every year from July to January of the next. I was first introduced to it in 1900; got the first larvae in 1906 and bred moths from that date to 1910. I wrote the first description of the larva on 8-11-1906 and the pupa on 19-12-1907. I have never seen a wild moth and the species usually must be very rare. It occurs in N. China, Khasis, Malacca, Celebes, and, now, in the Western Ghats, Bombay in the N. Kanara District.

The food tree is a common deciduous species in the Kanara jungles, occurring at all heights from sea level up and is perhaps commoner in the area covered by deciduous forest than in evergreen ones. Its Kanarese name is Sadagi but it is more widely known by the Mahratti name of Kusumb or Kosamb. It is also known as the Ceylon Oak according to Talbot and has been called the Travellers' Friend because it is one of the very first to break out into new leaf in March at the beginning of the hot weather. It then is a conspicuous object amongst its leafless companions owing to the young leaves being bright red, varying from delicate pink to nearly blood-colour and from occurring in small groups on nearly all hillsides (also on the flat and along the roads). The foliage finally all becomes green. An essential oil is obtained from the seeds and is the basis of the well known 'Macassar' hair-oil. The timber is hard, so hard that woodcutters object to felling the tree; which does not, however, prevent villagers from exploiting it to make sugar-cane mills with.



Asiatic two-horned Rhinoceros (*R. sumatrensis* Cuv.).



The author's best Asiatic two-horned Rhinoceros (*R. sumatrensis* Cuv.).

RHINOCEROS SHOOTING IN BURMA.

BY

W. S. Thom.

(*With one plate*).

Two species of rhinoceros, the Sumatran or double-horned rhinoceros (*Rhinoceros sumatrensis*) and the Javan or single-horned rhinoceros (*Rhinoceros sondaicus*) are said to exist in Burma. *R. sumatrensis* is the smallest known living rhinoceros and the most hairy, whilst its height seldom, if ever, exceeds 4 ft. 8 or 10 in. at the shoulder.

The Javan Rhinoceros (*R. sondaicus*).

I have shot several *R. sumatrensis* during my wanderings in Burma, but have never come across *R. sondaicus*, nor have I ever met anyone in Burma who had ever shot one. In fact, until a few weeks ago, I was under the impression that this animal had been long since exterminated and that it was not to be found anywhere in Burma at the present time. It seems, however, that I am wrong. We know, however, that it has recently been obtained in Sumatra where it apparently exists in fair numbers. It was formerly thought that only a few specimens existed in Java and the Malay Peninsula, and possibly in parts of Siam and Burma. This species was, however, originally described from Sumatra, but it has been a matter of doubt whether it still existed in the island.

Mr. G. C. Shortridge in an article entitled 'The Asiatic two-horned Rhinoceros (*R. sumatrensis*)' in the Society's *Journal*, vol. xxiii, No 4, p. 772, dated 25th May 1915, says, 'Besides the rhinoceros I shot (which was an example of *R. sumatrensis*), I have only heard of two other instances of a Rhinoceros being shot near Victoria Point by a European, one of these specimens, of which I have seen the skull, was *sondaicus* obtained some years ago by Captain McCormick, a former planter in the district, etc.' Mr. Shortridge says nothing more about *R. sondaicus*. As Mr. Shortridge was collecting for the Bombay Natural History Society, I take it he is an authority and knew what he was talking about when he identified the skull of the animal shot by Capt. McCormick as belonging to *R. sondaicus*.

Mr. E. H. Peacock, District Conservator of Forests and Game Warden, Burma (retired), in his book, *A Game Book for Burma and Adjoining Territories*, published in 1933, states that the height of a mature specimen of the Javan rhinoceros (*R. sondaicus*) is probably about 5 ft. 6 in. or roughly a foot higher than the Sumatran rhinoceros. Mr. Peacock says, "The best-known grounds used to be the forests of the Victoria Point Subdivision in Mergui District.* * * In this Subdivision the Javan rhinoceros was reported by all local hunters and guides to frequent heavy evergreen forests on flat or comparatively flat ground. It was supposed never to ascend high into the hills: i.e., into the typical habitat of the Sumatran rhinoceros.

"The forests of Victoria Subdivision undoubtedly held, at one time, a very fair number of Javan rhinoceros, but these have long since been poached out of existence for the sake of the valuable horn and blood which to realize an even greater price than that of the Sumatran rhinoceros.

"There are said to be four specimens of the Javan rhinoceros existing in the Kahilu Game Sanctuary in the Thaton and Salween Forest Divisions. Indeed, this Sanctuary was established mainly for their protection. These specimens are reputed to ascend hills in the manner of the Sumatran rhinoceros and, since they appear never to have been seen by any reliable authority, it is somewhat doubtful whether they are actually Javan rhinoceros or not." The fact that *R. sondaicus* does exist in the Sanctuary has however been since confirmed. Through the courtesy of Mr. S. F. Hopwood, Chief Conservator of Forests, Rangoon, Burma, and Mr. F. Allsop, Assistant Conservator of Forests, I have received an interesting letter dated 15th February 1935. Mr. Allsop writes that there is no doubt whatever that the rhinoceros inhabiting that area are *R. sondaicus*, Mr. Allsop spent about three weeks in the Kahilu Sanctuary and had the luck of actually seeing one rhinoceros at a distance of about 50 yards. It was in thick vegetation, but he was able to see the animal sufficiently clearly to say that it carried one horn about 9 in. long, set back slightly from the tip of the snout and that it was about 4 ft. 9 in. to 5 ft. at the shoulder. Mr. Allsop adds, that on two occasions within recent years, the dead bodies of female rhinoceros have been found in the Kahilu Sanctuary and that one was definitely identified by the Bombay Natural History Society as *R. sondaicus*. The skeleton of the second one was under examination at the time Mr. Allsop wrote and he has not been informed yet of the result to date i.e. 15th February 1935. Mr. Allsop has come to the conclusion from the tracks he has seen in the reserve that there were not less than six rhinoceros in the area in question, five being adults and one a calf.

Mr. Allsop has concluded from his own observations that the favourite foods of these animals are:—

(1) Leaves and stems of 'Suyit', *Acacia* sp. probably *A. pennata*, a climber.

(2) Leaves, stems and fruit of *Zizyphus glabra*, a thorny climber.

(3) Leaves and stems of *Cenocephalus suaveolens*.

(4) Leaves and twigs of *Trema orientalis* a very soft wooded tree common in secondary growth after shifting cultivation.

(5) Fruit of *Dillenia indica* (Bur.: thabyu).

Bamboos and grasses are eaten only to a very small extent, if at all. In addition to the food plants recorded above the same keeper of the Sanctuary states that the animals eat *Cudrenia pubescens*, *C. javanicus* (Bur: Sinswe Su), *Ficus pomifera* (Bur.: Kaaung), *F. hispida* (Bur.: Kadut), *F. hirta*, *Mallotus albus* (Bur:

Petwaing), *Erythrina lithosperma* (Bur.: Kathit) and *Homonoia riparia* (Bur.: Momaka).

Mr. Allsop in his letter goes on to say that there are a number of wallows many of them of long standing and that they are situated near the sources of permanent and semipermanent streams in the evergreen forest. The animals seem to visit them somewhat irregularly and capriciously. They appear to prefer to wallow fairly early in the morning, i.e., between 6 and 8 a.m. not in the heat of the day. The fragmentary evidence Mr. Allsop was able to collect indicates that they do not wallow daily but only once in three or four days and that individual wallows fall into disfavour and go out of use for a year or two at a time and are reopened later. No large deposits of dung were noticed, the rhinoceros evacuating almost anywhere with a slight preference for the pools of small streams. They do not return to the same place time after time as some species of rhinoceros are said to do. In view of the statements made by Mr. Shortridge and Mr. Allsop, and the definite identification of a skull by the Bombay Natural History Society there is no alternative but to accept the evidence that *R. sondaicus* does exist in Burma.

SUMATRAN OR TWO-HORNED RHINOCEROS (*R. sumatrensis*).

My experience of the Sumatran rhinoceros over a great number of years, during which I have, I suppose, seen quite fifteen or twenty of these animals at close quarters, has been that they are as active as goats and are really expert hill climbers. They will even negotiate country that neither bison nor elephant could possibly surmount. I have also found them on hills up to 4,500 ft. The Sumatran rhinoceros, although the hills are his proper habitat, occasionally descends to flat country especially towards the end of the rains, and remains there sometimes for long periods, till January and February, when there is still plenty of cover and mud and water to be met with everywhere. By March, as a rule, they are all back in high evergreen forests again. It is very rarely seen in the plains, so far as Arakan is concerned, during the hot weather months i.e. from March to June. Like pigs they sometimes wander about aimlessly for miles. I knew of one animal that descended from the hills and ravaged for several nights in succession a sugar cane plantation situated on the banks of the Kaladan River in Arakan between the Kyauktaw and Kaladan police posts. This happened during October, November and December, when the jungles are denser and damper than at any other time. It was often seen bathing in the Kaladan River by moonlight, by the people going up and down the river in dugouts.

Mr. Shortridge, in the same article referred to above, is mistaken in saying that *R. sumatrensis* 'apparently do not care for clear running streams and are said only to visit the low ground during the hot season when their drinking pools in the hills have dried up'. As a matter of fact, I have found *R. sumatrensis* at the top of the steepest of hills frequently drinking and wallowing in clear hill streams year in and year out at elevations varying from 1,500-3,000 ft. with not a vestige of mud or muddy water to be found for miles around except on low ground at the foot of the hills near permanent streams. The majority of the clear water hill streams in the Arakan Hill Tracts never seem to dry up.

I would state here once more that for such a clumsy looking animal, the Sumatran rhinoceros is an extremely active animal and a wonderful hill climber. On numerous occasions, when following their tracks I have had to hand over my rifle to a follower and climb up hand over hand steep banks that a Sumatran rhinoceros had ascended. Their tracks in the hills are generally most difficult to follow, especially when the ground is hard, or when it is covered with a thick layer of dead bamboo leaves. Should tracking be interrupted by a heavy shower of rain the bamboo leaves swell out, then the front or centre toenail impressions of the forefeet, which are usually the only marks that are visible on the ground are invariably almost obliterated. All rhinoceros have three toes on the fore and hind feet, unlike the Tapir (*Tapirus indicus*) which has four toes on the front and three on the hind feet.

Of all the wild animals in Burma I should say that the rhinoceros, the tapir and the takin, avoid the presence of man most and are therefore usually found further from villages than any other animal. I understand, however, that in the Kahilu Reserve rhinoceros have been feeding on chillies cultivated by the villagers. There is also the instance of *R. sumatrensis* which was found in Arakan in a sugar cane plantation situated on the banks of the Kaladan River not far from a village. There are always exceptions in every case for there can be no doubt that a rhinoceros is a very shy animal and usually avoids man. The rhinoceros's senses of sight and hearing are very poor, but its sense of smell is very acute. A rhinoceros once it has been disturbed is very difficult to come up with again unless it enters one of the mud wallows or swampy depressions. These wallows are frequented at odd times but especially during the hot weather months from March to June, when the gad or horseflies worry fourfooted animals most. I have watched herds of *Tsaing* (*Bibos banteng birmanicus* Lyd.) trotting along through the jungle during the heat of the day, as if the devil was at their heels, surrounded by clouds of gad flies and shaking their heads from side to side and snorting in their efforts to shake off their relentless tormentors. Most wild animals especially bison and tiger endeavour to lie up in the thickest cover they can find during the heat of the day in order to escape being bitten by these flies whose bites draw blood and cause intense irritation. Rhinoceros do not usually lie up during the day in very dense jungle. *R. sumatrensis* may be found lying asleep during the day either in a mud wallow, or at the foot of some shady tree or bamboo clump in fairly open jungle on top of some ridge, or hill, where he may catch any breeze that may be blowing. Most animals, especially bison, sambar and even elephant, like lying up for the day during the hot weather on some ridge to take advantage of the breeze during the heat of the day. I have, however, found old solitary bull bison, tsaing, elephant and even rhinoceros, seek the densest cover they could find, when their enemy—man—

had been hunting them persistently. The Sumatran Rhinoceros very seldom deposits its dung in the same spot daily. As a matter of fact, they seem to me to only do so when they accidentally cut across their own tracks at a spot where they have previously evacuated. The odour of the droppings, even though not their own, seems to attract the animal's attention and causes it to halt and evacuate on the same spot. It is not a regular habit. *R. sumatrensis* evacuate, sometimes when crossing a stream as do horses and elephants. *R. sumatrensis* change their feeding grounds generally once every ten or fifteen days. Sometimes, if the locality is a quiet one, far from the haunts of man and there are plenty of shrubs for them to browse upon, they remain in one place for nearly a month. I found that they generally fed along steep, well wooded valleys and also along the steep banks of well wooded mountain streams. The majority of these streams, so far as the Arakan Hill Tracts District is concerned, are full of rocks, high waterfalls and dense bamboo and cane jungle. In these rocky hill tracts there are no wallows. I noticed, however, that the animals in such places invariably had their baths in natural pools at the foot of waterfalls. Fine gravel and stones form the beds of these pools but there is no mud whilst there is usually about two or three feet of water in them. When feeding near these mountain torrents Rhinoceros just bathe, where it suits them, i.e., where there is sufficient water to cover their bodies when they roll about in it. The approaches to these mountain pools are very steep and inaccessible. The climbing one has to do when hunting these animals in these places, is really prodigious. One had often to make long detours to get round a succession of precipitous waterfalls, as it was quite impossible to ascend or descend most of the beds of the streams. We invariably carried about 50 yards of stout rope to enable us to surmount these waterfalls and steep ascents. One had also to be in the pink of condition to be able to keep going all day over the most trying country to be found anywhere in the world. These remarks apply more particularly to all the ranges of hills which skirt the Ru, the Lemro and the Peng Rivers in Arakan, where Sumatran rhinoceros are still fairly plentiful and which tracts of country ought, in my opinion, to be entirely reserved as sanctuaries by the Forest Department. The Ru stream is already a reserve, if I mistake not. The only other part of Burma where I found the Sumatran rhinoceros fairly plentiful was in the Yoma range of hills along either side of the watershed running between Arakan and the Thayetmyo District, inland from Kama and Mindon. They were also common along the Shwe-U-Taung range of hills in the Momeik State of the Ruby Mines District, but neither in the hills between Arakan and Thayetmyo or in the Shwe-U-Taung range did I find these animals in such inaccessible places as I found them in Arakan, especially in the steep hills which skirt the Peng and Lemro Rivers near Pengwa. I suppose they had been hunted so persistently and ruthlessly in Arakan by the hill tribes that they were finally driven to occupy these inaccessible places. When I was shooting along the watershed between Arakan and Burma, I noticed that *R. suma-*

trensis invariably made their wallows at the source of streams and in springs as near the top of the watershed as possible. Discarded wallows at lower elevations dry during the hot weather and are used again during the rains. An *R. sumatrensis* may have half a dozen or more wallows which it knows of and which it visits at odd times according to their dry or wet condition but it does not necessarily have a daily mud bath. These wallows are often enlarged by pigs as well as by elephants. A rhinoceros like a pig and a buffalo must have his bath, be it of mud, or of water. I have seen elephants also rolling about in the mud of a wallow to give their bodies a coating of it so as to protect their sensitive skins from the bites of flies and mosquitoes. Rhinoceros in the parts of the country about the Peng and Lemro Rivers often fed on anything green they could get. They must have been hard put to it at times to get anything really succulent to feed upon at all in these steep inhospitable bamboo clad hills. Except for an occasional small patch here and there, all evergreen forest seems to have been destroyed for cultivation purposes by the hill people by their wasteful system of felling timber and burning it. If it were not that the bamboo is a strong healthy shrub there would soon be none left either. Nothing for miles around can be seen but the *Kayinwa* bamboo (*Melocanna bambusoides*). *R. sumatrensis*, like most herbivorous animals, is very fond of the flower and fruit of this bamboo. This bamboo, as is well known, flowers and fruits once in thirty or forty years and then dies. I have seen thousands and thousands of acres of this bamboo laid waste at flowering. Nearly every junglecock for miles around seems to congregate in these areas when the seedlike flowers are on the stems or falling on the ground. There is also a kind of caterpillar at that time on the stems which seems to attract bird life to these areas.

The extraordinary thing is that there were no hens visible, only cocks. Either the caterpillars or the cornlike flowers of the bamboo, or both give them food. Many animals also gathered in these flowering patches of bamboo to gorge on the pearshaped fruit. I have known of village cattle gorging themselves on the fruit to such an extent as to die subsequently from the effects of overeating. After the bamboos wither and die, animal life disperses bamboo and there is an emigration of hordes of field rats. Where the bamboo has flowered and died wild plantain *Musa textilis* spring up everywhere in its place for acres and acres. Where does the seed of this plant come from? Has it been lying dormant all these years? Once the bamboo fruit takes root and springs up again the *Musa textilis* disappears. The strange thing is that this phenomenon is generally followed by epidemics of smallpox, or cholera, especially amongst the hill people. They are deprived at the same time of their food supplies in the tender bamboo shoots and are also unable, owing to the scarcity of bamboos, to make dah handles and mats or rebuild their houses which are usually constructed of bamboo. I could write more on this interesting subject but we are talking about rhinoceros, not bamboos.

R. sumatrensis also feeds on a kind of long, feathery looking grass called *pyaung-sa* or *kyan-sa*, bamboo leaves and shoots, prickly shrubs and creepers and the leaves of several species of plants with reddish coloured soft hairy leaves and stems found in certain localities in the hills or in the valleys and along the banks of streams. I am afraid I am not a botanist like Mr. Allsop so cannot give any botanical names.

Rhinoceros are generally found feeding very early in the morning and after sunset, and like the Tapir (*Tapirus indicus*), are more or less nocturnal in their habits. A rhinoceros is just like a big pig. He wanders about everywhere, north, south, east and west, as the spirit moves him. Once he has been disturbed or decides to change his feeding grounds, it is almost impossible to overhaul him. He travels at a quick walk for miles over the most abominable country imaginable until he reaches the desired spot. These animals could be easily run down and brought to a standstill with dogs as, in the hot weather, they do not stay very well once you have got them on the run; they invariably pull up every mile or so. I have never used dogs for this purpose of course, but I have almost been able to run down a rhinoceros on foot by keeping steadily on after him at the double mile after mile. It was hard work, but in those days I was as hard as nails and could stay for ever. When rhinoceros are hard pressed and thoroughly alarmed I have heard them utter loud whistling braying sounds in different keys, not unlike the braying of a donkey. At other times when I have followed and come up with an animal, it usually uttered a terrific snort not unlike that uttered by a large boar or gaur (*Bibos gaurus*) before galloping off after being disturbed. Rhinoceros also make a peculiar humming or buzzing sound when submerged in their wallows, especially when they have been chased or are tired and have just finished a long journey. It is partly a sign of exhaustion and partly a sign of satisfaction at being immersed in cool mud and water.

The carcase of a Sumatran rhinoceros is worth, to a Chinaman or Burman, nothing under a thousand rupees. The blood especially, if drawn straight from the heart, is valuable. It is dried slowly in bamboos over a fire and sold for almost its weight in gold. The horn again is more valuable than the blood as it is ground down, mixed with other drugs and used as an aphrodisiac and as a sovereign remedy for all sorts of ills. The Javan and Sumatran rhinoceros are considered of particular value for medical purposes by the Chinese and Burmese. The Chinese seem to know more than any other race about the uses to which the blood and horn of a rhinoceros can be put to. Fortunately the Burma Government have prohibited the shooting of rhinoceros in Burma altogether. There is no doubt that these animals are being slowly and secretly exterminated in the hills of Arakan by the wild tribes who come up and spear them in their wallows during the heat of the day. No one can tell what goes on in the Thayetmyo Yoma hills between Arakan and Burma as the Forest Department are under staffed, but the sooner some one is sent to keep an eye on the rhinoceros in the Arakan Hill Tracts the better.

Burmans can distinguish, as can any sportsman of experience, between a male and a female rhinoceros when following their tracks by noticing the way the young saplings, creepers or the branches of bushes have been twisted by the animal's horns as it moves along when feeding. A female or male with a short horn, according to the Burmese hunters, cannot do any twisting of branches, twigs and creepers. The more twisted the creepers, bamboos and branches appear, the better the chances of coming across an animal with a good horn. Another way of distinguishing the tracks of a female and male, there being very little difference in their size and appearance, is by carefully noting the positions of their droppings or dung. In the case of a male the ordure and urine will be found on the ground exuded one behind the other, a foot or two apart, whereas in the case of a female they will be found more or less together, or scattered over the bushes in the immediate vicinity at heights of from three to four feet. The urine of a female as seen by me on several occasions was of a pale pinkish colour. The male rhinoceros, when twisting bamboos, young saplings, and creepers, with his horns does so with the object of either cleaning or sharpening them or simply because of the pleasing sensation gained by the scratching. Perhaps it may be done as a challenge or from pure cussedness or sheer *joie de vivre*. Bison and tsaing and ordinary domestic cattle often tear up the ground with their hoofs and horns or rub them on the branches of trees or saplings for no apparent reason as do deer occasionally even when they have no velvet to get rid of, simply I take it, because the rubbing sensation pleases them. It may be of course a sex desire. Burman hunters have often told me that all big game are more restless, on the *qui vive*, and more truculent when the moon is on the increase and nearly full. Many races in India believe that a man is at his best when the moon is fullest.

One rarely comes across a young rhinoceros. During the 49 years I have been in Burma I have never seen either a young rhinoceros or the tracks of one. Burmese hunters say that rhinoceros bends its head to clear its path of obstructing jungle and heaves dead logs etc., over its back as it proceeds. These fall on the youngster following on the heels of its mother, and so kill or maim it. Hence the scarcity of young. This of course is a myth and can hardly be accepted as a true reason. I referred to this subject in the *Indian Field* sporting paper of September 30, 1909, in a long article entitled 'Notes on the Tapir (*Tapirus indicus*) and Rhinoceros (*Rhinoceros sumatrensis*).' The *Indian Field* became defunct a number of years ago. The real reason perhaps why rhinoceros are so scarce is because they have been so systematically and relentlessly hunted now for years past in all parts of the country where they eixst. The people are also well aware of the great value of the animal's blood and horns. The result is that the males are shot more frequently for the sake of their horns than the females which have small inferior horns, and as rhinoceros were never prolific breeders at any time, their chances of producing young ones are considerably lessened in consequence.

Rhinoceros get to their feet when disturbed and dash away at a much greater speed than would appear to be possible for such a heavy, clumsy looking animal. With a few exceptions, they, like all the other jungle animals of India and Burma, periodically visit salt licks where the earth and the water are slightly impregnated with salt or potash. The reason for these visits does not appear to have been much commented on by sportsmen generally in any country, for these salt deposits, or animal health resorts are to be found in every country in the world as well as in India and Burma. From an inspection of the tracks leading to and from some of these salt licks there can be no doubt that they are more often visited by the deer tribe than by any other quadruped. In fact these animals seem to visit the licks almost daily. The elephant, gaur or bison (*Bibos gaurus*), and 'tsaing' or banteng (*Bibos banteng birmanicus*) come next, in the order named "with a visit, of perhaps once or twice a week. Then comes the rhinoceros and the tapir with only one or at the most two visits a month. The moon seems to have a lot to do with these visits in the case of the tapir and the rhinoceros for they seem to come at full moon, and at the appearance of the new moon. There are regular beaten tracks leading to nearly all the most frequented salt licks and I have seen these pathways literally churned up into a sea of mud by the hooves of animals coming and going. It should be noted, however, that these salt licks are only popular at certain times of the year. There is a regular season when animals partake more freely of the brackish earth and saline water, while at other times there is a regular falling off in the number of visits paid by all the larger animals such as elephant, rhinoceros, tapir, gaur and tsaing. More visits are apparently paid to such licks between the months of December and June than at any other period. Some salt licks, which are more highly impregnated with salt deposits than others and which are situated in the heart of the jungle far from the haunts of man, are naturally frequented more often than those situated near villages and cultivation. During the monsoon, from July to October, most of the salt licks become inundated with water and then the earth no doubt loses, to a considerable extent, its saline properties and is consequently less palatable.

I am of opinion that animals partake of saline mud and water as an aperient when they wish to free their systems of parasitic worms which are found in the stomachs of both bird and beast the world over, and which, if not expelled before they multiply to any great extent cause great trouble and are also the means of disease breaking out amongst them. On more than one occasion I have observed these parasites among the droppings of elephants which have eaten the saline earth at these deposits. The large quantities of earth which an elephant will put away at one visit is simply astonishing. I once watched, at a distance of only about ten paces, an old tusker elephant pick up and shove, down his throat with his trunk, a quantity of this saline earth weighing quite thirty to thirty-five pounds before departing to drink at a neighbouring stream. At some salt licks only the water is drunk out of pools which are sufficiently impregnated with saline matter. None of the cat tribe, i.e., tigers, leopards or cats, ever partake of the waters or eat the earth at a salt lick. Bears and pigs also do not visit salt licks. I have however, seen jungle fowl, pheasant and imperial, as well as green pigeon, and also the gibbon monkey sipping water at a saline pool. There is some mysterious fascination about a salt lick that seems to attract animals and birds to it whether they do or do not partake of the waters or salt earth there. Tiger and leopard of course prowl round salt licks on the chance of killing an animal for food.

Sitting up at a salt lick in India or Burma with or without electric contrivances is now strictly forbidden.

A rifle of any of the following calibres is good enough for use upon the Burmese rhinoceros viz. 500, 470, 450, 423 and 12 bore Magnum Explora ball and shot guns. I am of opinion that *R. sumatrensis* are not given to charging even when wounded.

My first experience with the Sumatran rhinoceros, was on the Shwe-U-Taung range of hills between the state of Momeik and the Ruby Mines District of Upper Burma. My hunters and I had struck the tracks of a Sumatran rhinoceros one morning at about 8 a.m. I was armed with a 12 bore hammerless ejector 'Paradox' gun firing a cordite charge and heavy conical bullets. With this weapon in one hand I could, if necessary, sprint several hundred yards after an animal without getting blown. My second weapon, which was meant to act as a stopper in case I should be charged by, say, an elephant or a bison, was an 8 bore rifle burning a charge of 10 drs. of black powder with heavy conical bullets of hardened lead. At 3 p.m., after we had taken many twists and turns through bamboo jungle and tree forests, up and down very steep hills full of giant stinging nettles, my best tracker, Maung Pe, suddenly turned round to me and pointing to some mud smears on the leaves and stems of the surrounding bushes whispered 'Sir, we are not far from a rhinoceros wallow—please keep a careful lookout ahead'.

After striking a match and blowing it out to see which way the smoke travelled, whether the wind was in our favour or not, I took the lead, and after travelling a matter of about 50 yds. or so and going round the base of a large ant hill surrounded by some low bushes, I suddenly heard a splash ahead and found myself within ten yards of a rhinoceros that had risen out of his wallow and was sitting on his hind quarters looking in our direction. Firing both barrels into his head in quick succession I sprang to one side in case he should charge along the path by which I had come. On receiving my shots, he dashed out of the wallow at a great pace, uttering a loud snort, the noises emitted by his feet as he withdrew them from the thick mud sounded like the withdrawing of corks from large champagne bottles. Thinking I had missed him altogether for he never flinched or showed any signs of having been hit, we followed on. After travelling 20 or 30 yds., blood was discovered on either side of his tracks which was a clear indication that one of my bullets had found its mark but, evidently without touching the brain. After going about a quarter of a mile we came upon him lying down breathing stertorously. I then let him have a right and left with the Paradox as he faced us. I then saw that only one of my bullets had passed through his head. The anterior horn was small—being only about 12 in. in length, whilst the posterior was a mere horny protuberance (see Pl. upper photo). The animal was then cut up and the meat smoked over a large fire being subsequently divided among my men. I found the meat, if properly cooked, quite palatable. It was as good as beef at any rate if not better. It should be mentioned that not a scrap of any animal shot by me has ever been wasted. If my servants, camp followers and coolies did not consume it, villagers from the nearest village usually flocked in and scrambled for the remnants. The entrails, and even the bones and skin were taken away.

On another occasion, in the Ruby Mines District of Upper Burma, my hunter and I were tracking up a solitary tusker elephant which, judging by the measurement of its fore-feet impressions which taped 20 in. from toe to heel, indicated that the weight of ivory carried by the animal must have been in the neighbourhood of 70 or 80 pounds the pair. Unfortunately when we were about a mile to the rear of the animal it walked into a camp of Burmans who were engaged in cutting bamboos, and, after demolishing their huts and nearly catching one or two of the occupants had gone clean away. However, these bamboo cutters gave us the information that they had that morning seen—it was then only about 8 a.m.—the tracks of two rhinoceros which seemed to be travelling together. This was good news and it did not take us long to pick up their trail, and, finally, after following them for some time I suddenly caught sight of them entering a huge mud wallow in the side of a hill. One of the animals must have got a slant of our wind for he suddenly slewed round and cleared out of the wallow at a fast trot. The other, however, after staring about him stupidly for a minute or so, trotted in our direction. I waited till he came abreast of me, and at a distance of about 30 yds., I let him have a shot from the 8 bore. This did not stop him. He seemed to travel faster, if anything. We took up the tracks but could get no sign of blood. 'A clean miss, Sir, I am afraid', said Maung Pe. 'How could you have missed such an easy shot?' There was no doubt about it. I had clearly missed and there was no more to be said about it. I had no excuse to offer except to remark to him that even the most expert marksman occasionally misses. However, we took up the tracks again. It was a long stern chase. The time was about 10-30 a.m. We travelled all day on those tracks until rhinoceros tracks, stones, earth, bamboo clumps, bushes and trees seem to have been indelibly, photographed on the brain and in the retina of my eye. At about 5-30 p.m. I heard a peculiar, deep humming or buzzing sound, akin to the noise of wind passing through the feathers of the Great Hornbill (*Dichoceros bicornis*) as it beats through the air. 'The sound we have just heard', said Maung Pe, 'was made by a tired rhinoceros blowing or breathing in his wallow. There is, no doubt about it. I have heard it too often to be mistaken now.'

Accordingly we pushed on cautiously and in less than 5 minutes we were at another wallow. So close was I standing to the mud hole that I could have easily inserted a ten foot bamboo into the mud beneath me. I could see a heaving mass of mud but could not make out which end was the animal's head and which the tail. Only a little bit of the yellow looking clay covered skin of its body was visible. This seems incredible, but is perfectly true nevertheless. As I was certain there was no possibility of my missing this time, I fired the right barrel of the 12 bore Paradox into what I took to be the centre of the body, it being impossible for me to tell where the animal's head lay, so deeply was it embedded in the mud. On the report it rose out of the mud, and, after spinning rapidly round in circles for a few seconds, dashed out of the wallow, making loud popping sounds with its feet as it pulled them from the mud. I knew there could be no mistake this time and that it was hit. It only travelled a distance of about 500 yards and when I came up with it, it uttered a long drawn out scream and expired. This animal I am sorry to say turned out to be a female. She had a mere stump of a horn.

On examination, I found that my bullet had passed through her lungs. According to Maung Pe, she was the same animal I had fired at that morning, as we found the graze of a bullet on her withers, which had cut the skin but had not drawn any appreciable amount of blood. I must say that her dying scream caused me remorse.

I shot my best *Rhinoceros sumatrensis* (see Pl. lower photo) on a range of hills bordering the Lemro River in Arakan at an elevation of about 3,000 ft. I was travelling up the Lemro River in dugout canoes to visit and inspect an out of the way police outpost situated at a place called Pengwa. A weird looking wild man of the woods from a neighbouring Chin village visited my camp on the river and informed me that he knew of a small pond or pool of water on the top of the range of hills above us which used to be visited frequently by rhinoceros in bygone years.

Next morning we started off at daylight for the top of the range of hills hoping that we might have the luck to come across a rhinoceros with a really good horn. I had been told that the part of the country we were about to visit had not been shot over by any Europeans or even local hunters for many years. I found the going steep enough in all conscience and I was soon bathed in perspiration. The men all carried small muslin bags or pads some five inches square, full of wet powdered tobacco, and whenever a leech got on to their legs they just squeezed a few drops of the juice on to it which immediately caused it to curl up and drop off. Salt or gunpowder is equally efficacious.

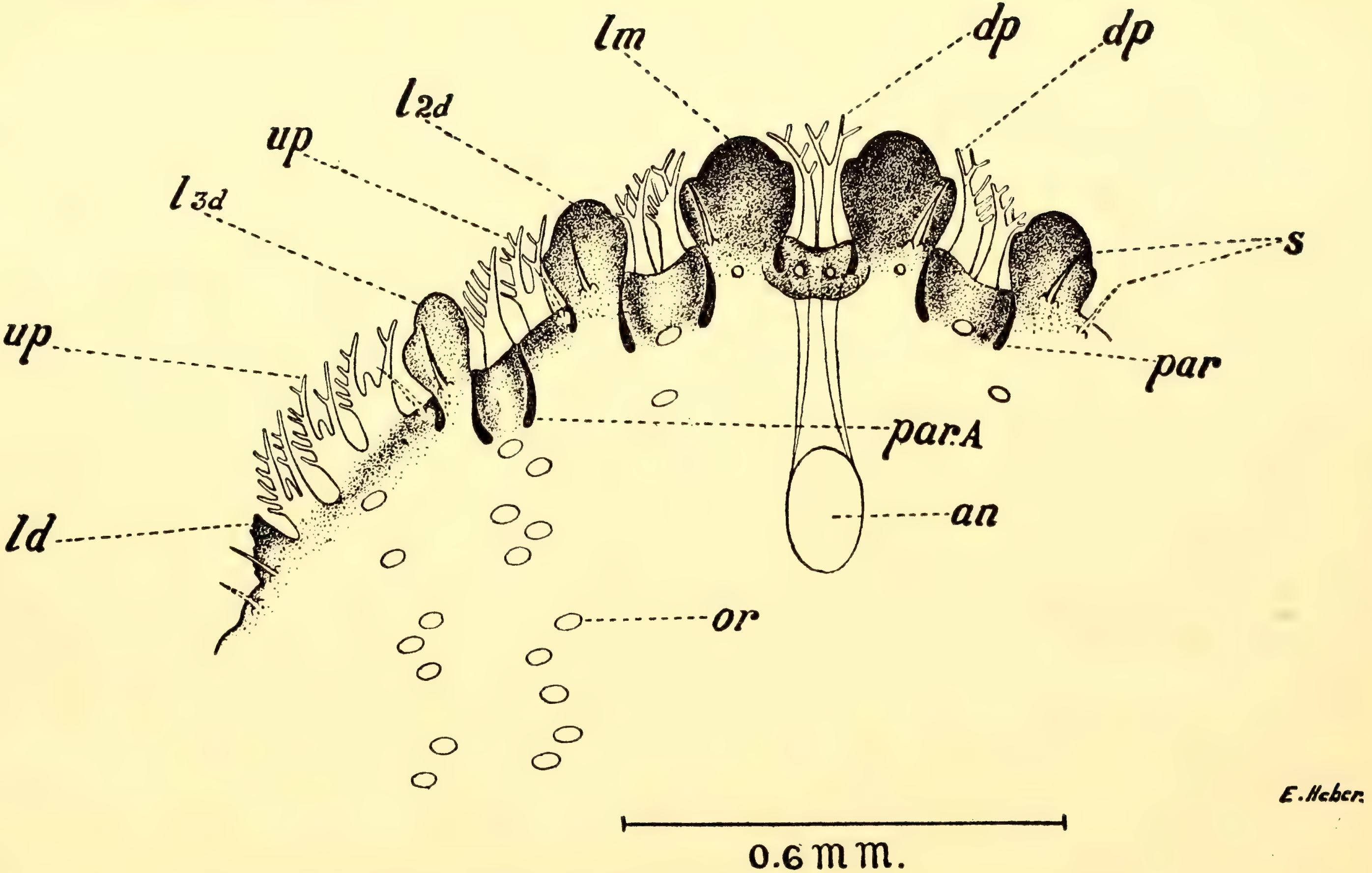
We reached the top of the hill at about 1-30 p.m. when down came a heavy shower of rain which drenched us all to the skin. This made things rather unpleasant, for the leeches gathered round us in battalions and attacked *en masse*. At about 3-30 p.m. after much wandering about in our efforts to find the rhinoceros's wallow I caught a glimpse of a small sheet of water through the bamboos. I at once took the lead armed with a single Westley

Richards 500 bore cordite rifle which burnt a charge of 80 grains of cordite.

My guide, the wild man of the woods, then whispered to me that the rain was bound to bring a rhinoceros to the wallow as the sun was shining brightly whilst it was hot, and the gadflies were in evidence everywhere. To cut a long story short I crept to the pool along an elephant path, and sure enough saw, not only a doublehorned Sumatran rhinoceros with a fine posterior horn but also a very fine bull elephant with a very good pair of tusks. The latter was throwing mud and water backwards over his body and between his fore legs to cool himself and to drive away the gadflies. The rhinoceros was standing alongside the pool within ten yards of the elephant which seemed to take absolutely no notice of its presence. A cock silver pheasant (*Gennaeus lineatus*) was also standing beside the pool between the two animals. I could not shoot both the animals, and as the rhinoceros was the bigger prize of the two, I decided to bag it if I could. As the rhinoceros was standing almost broadside on to me with its head turned slightly away, I moved forward to my right to obtain a better position and also to get slightly nearer. We were now only about 25 yards apart and I wanted to be able to deliver a raking shot from a little behind. What would I not have given to have had a camera at that moment? I should have been able to obtain an excellent shot of both animals on the same plate. However, I waited no longer and let the rhinoceros have a raking shot through the small of the ribs in the hope that it would find the lungs if not the heart, hoping at the same time that the elephant would clear out in the opposite direction and not worry us as I did not want to shoot the animal. The rhinoceros lurched forward on receiving the shot and swung quickly round in my direction with his head in the air. Having got my wind, the breeze having veered round, he charged through the pool very quickly, but whether it was an intentional charge or not, I am unable to say. The elephant on hearing the report banged his trunk once on the ground, and after uttering a shrill trumpet, went off in full flight through the bamboos and jungle making a devil of a noise. I had by now taken up a position some fifteen paces from the pool and as the rhinoceros reached the edge of the water on my side, I dropped him with a broken shoulder, and finished him off with a third shot. He had a very fair anterior horn of a length of about 16½ in. The posterior horn was only from about 2½ to 3 in. long. After disembowelling the animal in order to save the meat for my men, the next day, and taking some photographs of it and the pool, as well as several of it being skinned, we hurried back to camp which was reached in inky darkness at about 9 p.m., after a desperate scramble through the jungle and undergrowth, the leeches crawling all over us *en route*. One of my men had a leech in either nostril, whilst another had one fixed on the white of one eye ball. The man with the leeches in his nostrils was able finally to pass them out into his mouth when they had become sufficiently gorged with blood. I had a similar experience some years before, so was able to explain to him how to eject the leeches. There is in fact no pain but only a slight itchy feeling in the nose, and the only thing to do is to wait until the leech has gorged itself with blood and then to pass it out through the nasal passage into the mouth in the usual way from whence of course it should be ejected at once. It sounds horrible, but necessity knows no law, and this method is sheer necessity. In the case of a dog getting a leech up its nose the only thing to do is to hold a bowl of water under the nose of the animal till the leech longing to reach the water hangs low enough down to enable it to be seized with a pair of pincers or a piece of cloth and pulled out. A solution of salt water can also be injected into the nose. Some people recommend tobacco juice but this may affect the brain or the eyesight and is unsafe.

With regard to my shooting kit, I wore as footgear the brown canvas and rubber hood 'Workshu' with two pairs of socks, and shorts and coat made of green coloured shikar cloth. The inner pair of socks worn were either of strong, thick, closely woven silk or cotton. Over these I wore thick woollen socks. In order not only to prevent the socks from slipping down into the heel of the boot and causing blisters, but also to keep out sand and gravel I wore half a putty wound round the top of the boot which also to some extent prevented leeches from getting at the foot at all through the eyelets or lace holes of the boot. When leeches did happen to worm their way through the lace holes of my boots and get through the thick woollen socks they were quite unable to get through the cotton or silk socks, with the result that as they could not draw blood from anywhere on the foot they were obliged to wriggle out again on to the bare calf or thigh where the tobacco sachet could easily deal with them. Leech bites on the calf or thigh are not nearly so irritable as bites on the instep, ankle, or foot. If a leech bite is scratched by anyone whose blood happens to be out of order, it is apt to turn into a nasty sore which is difficult to heal.

Shorts are the only togs worth shooting in. One cannot climb really steep hills wearing riding breeches and putties or in fact any other kit, if there is to be any hill climbing, owing to the stoppage of the circulation of the blood in the legs. It simply cannot be done.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Dorsal view of the pygidial margin and fringe of the Red Scale (*Chrysomphalus aurantii*, Mask.).
(For explanation of plate see end of article.)

AN ACCOUNT OF THE OCCURRENCE OF *CHRYSOMPHALUS AURANTII*, MASK AND *LACCIFER LACCA*, KERR ON GRAPE FRUIT IN RANCHI DISTRICT, CHOTA NAGPUR, WITH A NOTE ON THE *CHALCIDOID* PARASITES OF *ASPIDIOTUS ORIENTALIS*, NEWST.

BY

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(*With a plate*).

Chrysomphalus aurantii, the Californian Red Scale, although a serious pest of *Citrus* in many parts of the world, particularly in California and Egypt, does not occur as a pest of any great importance in India. It has been recorded in this country on the following, but in no case as a serious pest. *Agave americana*, *Citrus decumana* (pomelo), and *C. aurantium* (orange), *Cycas cincinalis* and *C. recurvata*, *Jasminum*, *Morinda tinctoria*, *Morus sp.* (mulberry), *Psidium guayava* (guava) and on Rose.

In this district *C. decumana* fruits are commonly found lightly attacked by the scale, and garden rose is occasionally severely attacked. A number of *C. decumana* trees introduced at Namkum in 1927-28 were found to be slightly affected by this *Coccid* in February 1933.

Mr. H. T. Bates, then Manager of the Sabaya Division of the Assam Frontier Tea Company, introduced in June 1930 a small number of one year old grafts of the Grape Fruit *Citrus decumana* var. *grandis* at Sabaya. These plants established themselves satisfactorily, but in March 1931 were found to be attacked by *C. aurantii*, the attack was not very heavy but was of sufficient intensity to warrant control measures, a reinfection was observed in January 1933 and control measures were repeated.

At this time, one of the plants was observed to be lightly infected with lac (*Laccifer lacca*, Kerr), the infection having originated apparently from a *Zizyphus Jujuba* (Ber) tree close by, which had been purposely infected for the Baisakhi crop. This is an example of lac as a pest, and the infected plant was treated in the same way as those affected by *C. aurantii.*

Of the sprays utilised Lime Sulphur was found to be effective against both *Coccids* but is not to be recommended as it scorches the foliage severely. A resin spray made up as follows was found to be fairly satisfactory. It is similar to that used by Barritt (1929) against *Chrysomphalus aonidum* in Egypt.

Resin	1 lb.
Crude Castor Oil	3 lbs.
Ammonia	1¼ lbs. (sp. gr. 0.888)
Water	180 lbs. (18 gals.)

The resin and castor oil were heated together till the former dissolved, the solution was allowed to cool and was stirred into the water to which the ammonia had previously been added. The resultant solution is a white coloured sticky emulsion, which is ready for use. It may be kept in sealed drums.

The most effective spray tested was a Kerosene soap emulsion made up as follows:—

Stock.

Kerosene Oil	2 gals.
Karunj Soap	½ lb.
Water (soft)	1 gal.

The soap was dissolved in water heated to boiling, the kerosene was added to the mixture while still boiling hot and stirred until a thick creamy fluid resulted. The success of the spray depends to a considerable extent on the efficiency of the stirring. The solution may be kept in sealed drums. This stock if properly made should adhere to glass without separating into oily particles, and when spread with the ball of the finger should form a fine continuous film. It will keep for a considerable time. If insufficiently stirred the oil will separate and collect at the top.

For use the stock was diluted with water, 1 part stock to 3 parts water, and at this concentration did not scorch the foliage. Tests should however be made with various dilutions as the susceptibility of foliage to scorch varies very considerably. Spraying preferably should be done in the evening or on cloudy days, not in the full heat of the sun as this tends to cause scorch.

The female scale can be identified by the following characters:—

Scale approximately circular, average diameter about 1.5 mm., median area slightly convex, marginal area broad and flat. The scale is semi-transparent, and shows the outline of the insect below, the colour is grey, but actually appears orange yellow except marginally due to the colour of the insect lying below. The exuviae are central or nearly so, bright orange red or orange yellow in colour and are somewhat obscured by secretion. The first exuvia bears a small central boss which may bear a small nipple of white wax, the cicatrix. The exuviae are highly polished beneath. The whole dorsal surface except marginally in the living insect appears therefore orange red or orange yellow in colour.

The ventral scale is well developed, thin at the centre, stout towards the margins firmly attached to the dorsal scale, and to the body of the female as is also the dorsal scale, making the extraction of the insect difficult except by dissolving away the scales in Potassium hydroxide.

The morphology of the female has already been fully described by a number of writers including Green (1896), Newstead (1900), Herrick (1911) and Quayle (1911). The most conspicuous features are that in the living insect the rostrum is usually pushed a little to one side, and that at the period of gestation the pygidium is partly contracted within the body and is overlapped and sometimes almost enclosed by the sides of the thorax.

The pygidium of the specimens examined showed certain small differences from the normal, which are probably local variations. (see Plate)

The second lobe is frequently rounded internally and notched externally, but may be notched on both surfaces, the third lobe is almost invariably notched externally and rounded internally.

The pectinae are arranged 2-2-2-3, those in the median and second incisurae distapectinae, those in the third incisura and on the lateris unapectinae. The first pectina in the third incisura and the three pectinae on the lateris have two equal branches, between which in the case of those on the lateris a finger-like projection occurs. The unapectinae are fringed on their external margin only and in the case of the bilobed pectinae the fringing on the internal lobe is greatly reduced.

There is a pair of paraphyses to each lobe, the external paraphyse of the second lobe is much reduced and may be absent. In all specimens from this locality a distinct club-shaped thickening of the cuticle of the dorsal surface arises from the base of the third incisura (see Plate, par A), whose structure exactly that of a paraphyse, but whose disposition is abnormal. It forms the internal border of the paraphysial furrow occurring in the third incisura which would normally be formed by the external paraphyse of the second lobe.

A seta occurs external to the latadent on the ventral surface in all local specimens corresponding with the setae occurring external to each of the second and third lobes on the ventral surface.

The four calles of typical specimens occur as transverse bands of thickenings in the cephalic region of the dorsal aspect of the pygidium; in local specimens, the lateral calle is the longer and more prominent, the median is shorter and is in many specimens broken into two separate unequal parts which are adjacent, and which are occasionally connected by a narrow neck.

In view of the absence of genacerores and densariae and the presence of paraphyses, it seems probable that this species is referable to Leonardi's Genus *Aonidiella*, a course which has been followed by certain Authors.

A single adult of the *Aphelinid, Aphytis chrysomphali*, Mercet was taken resting on a twig infected with *C. aurantii.* This species has been reared in small numbers at Namkum from *Aspidiotus orientalis* on *Zizyphus Jujuba* (Ber).

I should like to thank Sir Guy A. K. Marshall, F.R.S. and Dr. Ferrière for the identification of this and the following species.

A. chrysomphali is reported by Quayle (1932) as one of the commonest parasites of the Red Scale in California, he also records it from the Yellow Scale *Aonidiella* (*Chrysomphalus*) *citrina* Coq.

Comperiella bifasciata, How. (*Encyrtidae*) is a common parasite of *A. orientalis* in this district. Quayle (1932) records this species from the Yellow but not from the Red Scale in California.

Other *Chalcidoidea* bred from *A. orientalis* at Namkum were, *Physcus sp.* (near *flaviventris* How.) which was rather rare; *Tetrastichus purpureus* Cam (*Eulophidae*) as a primary and probably also as a secondary parasite (Glover, 1933), and *Marietta javensis* How. (*Aphelinidae*) as a hyperparasite of primary *Chalcidoid* parasites of this *Coccid* (Glover, 1933, reported as *Perrisopterus sp*).

In conclusion I wish to express my thanks to Mrs. Dorothy Norris, Director of this Institute, and to Dr. C. F. C. Beeson, Forest Entomologist, Forest Research Institute, Dehra Dun, for advice and criticism, to Mr. H. T. Bates for permission to experiment on his trees and to Mr. E. Heber for preparing the plate.

Since this paper was submitted for publication on July 7th 1934, a paper on the Genus *Comperiella*, Howard by Dr. T. V. Ramakrishna Ayyar has appeared in *Records of the Indian Museum*, vol. xxxvi, pt. II, [illegible] this paper Ayyar records the Genus *Comperiella* from India for the [illegible] and describes a new species *C. indica* sp. nov., which he [illegible] às *Comperiella sp.* parasitic on the tamarind scale *Aspi*[illegible] at Coimbatore where it occurs on tamarind often associated [illegible] *orientalis*, N. (Imp. Inst. Agric. Res., Pusa Bull. 197,

Comperiella bifasciata is therefore recorded from India for the first time, and is the second species of this Genus known to occur in this country. *C. bifasciata* and *C. indica* are very similar, particularly as regards colouration, but may be separated by the fact that in the former the fore wing of the female has two divergent brownish fasciae, and that in the latter the fore wing of the female has one brownish fascia only.

Aphytis chrysomphali is believed to be recorded from India for the first time.

EXPLANATION OF PLATE.

Dorsal view of the pygidial margin and fringe of *Chrysomphalus aurantii*.

an., anus; dp., distapectinae; ld., latadent; lm., median lobe; l. 2nd, 2nd lobe; l. 3rd, 3rd lobe; or., oraceratubae; par., paraphyses; par. A., extra abnormally disposed paraphyse; s., setae; up., unapectinae.

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NOTES ON THE SYSTEMATIC POSITION OF *SANSEVIERIA* GROWING IN INDIA WITH SPECIAL REFERENCE TO *S. LAURENTII* WILDEMAN.

BY

KALIPADA BISWAS.

About sixty-eight species of Sansevieria are known up to the present time. Of these only four are supposed to be indigenous to the Indian Empire. These are *S. lanuginosa* Willd., *S. zeylanica* Willd., *S. Roxburghiana* Schult., and *S. burmanica* N. E. Brown. *S. lanuginosa* grows wild in sandy places in Malabar coast. *S. zeylanica* is common in the drier rocky and sandy region. *S. Roxburghiana* is the most common species, and is fairly widely distributed along the coast of Coromandel, Lower Bengal, Orissa and Chota Nagpur. *S. burmanica* is wild in Upper Burma. But the systematic position of *S. lanuginosa* as a distinct species has been rightly doubted by N. E. Brown in his valuable monograph on Sansevieria published in *Kew Bull.* No. 5, p. 226, 1915, where he remarks 'It appears to be similar to *S. zeylanica* Willd'. Thus *S. Roxburghiana* is the only known species indigenous to India proper.

Most of the species of Sansevieria are confined to Africa or to the islands near its coasts and a few to Arabia. Nearly all the species found cultivated in different parts of the world are introduced. In the Royal Botanic Garden, Calcutta, there are about seven or eight species under cultivation. Of these again *S. trifasciata* of Prain is supposed to have been grown in this garden as early as 1899. It is also reported from Jalpaiguri and from Lower Sikkim area but recorded as cultivated. Prain mentions in his *Bengal Plants*, vol. ii, p. 1054, 1903, this species as 'often cultivated; sometimes as an escape' closely related to West African Bow String Hemp (*S. guineensis*) but with narrower, more definitely maculated leaves. Brown is of opinion that *S. guineensis* is not correctly named. Prain noted this species (*S. trifasciata*) as a horticultural species both in his *Bengal Plants* and subsequently in the *Rec. Bot. Sur. of India*, vol. iii, No. 2, p. 287, 1905. But Prain's *S. trifasciata* resembles very closely Dr. J. Murce's specimen of *S. nilotica*, a native of Tropical Africa, which was described by Baker in the *Journ. of Linn. Soc.*, vol. xiv, p. 548, 1875.

During comparatively late years an interesting specimen of Sansevieria with yellow striped leaves is under cultivation in and about the Royal Botanic Garden, Calcutta, and Victoria Gardens, Bombay, and elsewhere in this country (See Plate I). This species so far as its specific characters are concerned may be taken as a variety either of *S. nilotica* or of *S. trifasciata*. Considering its distinct yellow stripes of the leaves Brown takes it as *S. trifasciata* Prain, var. *Larentii* N. E. Brown. The problem which the writer attempts to solve is whether the yellow striped specimen be taken as a variety of *S. nilotica* or *S. trifasciata* and whether the latter should be considered a separate species. Comparison between the descriptions of *S. nilotica* of Baker and *S. trifasciata* (Hort.) Prain, shows that there is not much difference between the two species. Thus there is not sufficient ground for considering *S. nilotica* and *S. trifasciata* as two distinct species. Therefore, the question is whether *S. nilotica* or *S. trifasciata* is to be retained. According to the rules of nomenclature *S. nilotica* has been described earlier. Hence it is advisable to reduce *S. trifasciata* to *S. nilotica*. *S. trifasciata* is not an Indian species, but it is a West African species cultivated in Lower Bengal. Prain himself observes under *S. trifasciata* as follows: 'Cultivated but also sometimes in village shrubberies probably native of West Africa, but appears to have reached India from America where it is sometimes grown as *S. guineensis*, the West African Bowstring Hemp which is not naturalized and is hardly known even in cultivation in India.' Meunissier remarks that this plant has all the characters of *S. guineensis* except the yellow stripes of the leaves. Evidence recorded in the literature and examination of type sheets of Prain's *S. trifasciata* lead to the conclusion that *S. nilotica* of Baker is very likely the same species as *S. trifasciata*. Prain himself, as his above notes indicate, considers *S. trifasciata*, as grown in the Royal Botanic Garden, Calcutta, and other places, a horticultural form or variety—as may be called—of a tropical species, very likely *S. nilotica*. Prain's remark on the herbarium sheet of *S. trifasciata* confirms the above conclusion. The chief distinguishing characters, according to Brown, of *S. nilotica* Baker and *S. trifasciata* Prain, are as follows:

S. nilotica.	*S. trifasciata*.
Leaves 2–3 to a growth ; strap shaped with sides for a foot or more of the central part, deeply concave-canelled, petiole 1–2 feet long.	Leaves often 1–2, in vigorous plants 2–6 to a growth ; linear lanceolate or narrowly elongated lanceolate.
Bracts $\frac{1}{12}$–$\frac{5}{12}$ in. long. ...	Bracts $\frac{1}{8}$–$\frac{1}{2}$ in. long.
Flowers 4–10 in. cluster. ...	Flowers 3–8 in. cluster.
Flowering lobes $5\frac{1}{2}$–6 in. ...	Flowering lobes 7–9 in.

These distinguishing characters of the two species are overlapping and not quite definitely demarcated. The authentic herbarium specimen taken as *S. trifasciata* differs from yellow striped garden specimen as much as the herbarium specimens of *S. nilotica* differs. The yellow band is a very distinct character in the garden plant. The general characters noted in Brown's key to the genus in the *Kew Bulletin*, No. 5, p. 194, 1915, are applicable both to *S. nilotica* and *S. trifasciata.* The character: Leaves 'sometimes striped with yellow' is evidently mentioned to include the var. *Laurentii* of *S. trifasciata,* formerly confused with *S. guineensis,* as remarked by Prain in the *Bengal Plants,* vol. ii, p. 1054, 1903, and *Records Bot. Surv. of India,* vol. iii, No. 2, p. 287, 1905. Prain's *S. trifasciata* is quite a distinct plant from *Dracaena ovata* and *S. guineensis* as figured in *Bot. Mag.,* pp. 1180-81, 1809, and referred to in *Conspectus Florae Alfricae,* Durand and Schinz, vol. v, p. 140, 1895. The original descriptions of *S. nilotica* of Baker as published in the *Journ. of the Linn. Soc.,* vol. xiv, p. 548, 1875, is applicable to *S. trifasciata* of Prain as well. As far as my investigation leads me, I consider that there is not sufficient difference between *S. nilotica* and *S. trifasciata* as regards their specific characters are concerned. *S. trifasciata* of Prain may perhaps be conveniently reduced to *S. nilotica* Baker. I would, therefore, prefer to consider *S. trifasciata* a synonym of *S. nilotica.* Slight difference in the nature of the leaves and dimensions of the floral structures might be due to climatic conditions and horticultural manipulations. The illustration of the horticultural species—*S. Laurentii* given in *Gardeners' Chronicle,* vol. xlv, p. 347, 1909, is considered as a variety of *S. trifasciata* by N. E. Brown. This *S. Laurentii* is the one which tallies best with the yellow striped specimen. The living specimen was also received as *S. Laurentii* by Dr. D. S. Laud, Superintendent, Victoria Gardens, Bombay, as his following note indicates:

Sansevieria Laurentii Hort. (*S. Laurentii* Wildeman).

'Hab.—Tropical Africa, was introduced in these Gardens from Messrs. L. R. Russell, Richmond Nurseries, England, on 29th March 1923. It is cultivated in these gardens as an ornamental plant both in the open and in the conservatories for the beauty of its leaves. It has a band of creamy yellow $\frac{1}{4}$-$\frac{1}{2}$ in. or more wide along the leaf margins in addition to the regular variegation. This plant flowers and seeds in this garden. The flowers are whitish green. No attempt is made to propagate from leaf-cutting. The plant is easily propagated by divisions.'

'Mention has also been made of this variety of Sansevieria by Mr. Macmillan in his book—*Tropical Gardening and Planting,* p. 154.'

Propagation from fragments of yellow striped leaves at the Royal Botanic Garden, Calcutta, resulted in the development of a plant without yellow stripes in the leaves, although plants raised from rhizome produced plants with yellow striped leaves without fail. Reversion to plants without yellow stripes in the leaves when raised from leaf cuttings was recorded by Gerome, the head gardener at Paris, in 1914. Gerome received the yellow striped specimen directly from Prof. E. Laurent who brought this interesting plant from Belgian Congo. Experiment at Kew, as Brown mentions, had similar results. A Meunissier in *Gardeners' Chronicle,* vol. lvi, p. 144, 1914, surmises that such bad mutation —I mean reversion to parent plant when raised from leaf cuttings

—is due to variation in cell structure in the rhizome and yellow striped leaves.

Considering the facts mentioned above, this yellow striped specimen may better be taken as *S. nilotica* Baker, var. *Laurentii* Wildeman. A detailed description of this variety as observed in the fresh specimen in comparison with the herbarium sheets of *S. nilotica* and *S. trifasciata* of Prain is given below:

Sansevieria nilotica Baker, var. *Laurentii* Wildem.

Synonym—*S. trifasciata* (Hort.) Prain, var. *Laurentii* N. E. Brown; *S. Laurentii* Wildem.

Plant with underground creeping stem, 1.3 to 2.5 cm. thick; leaves 2-3-6 to a growth, 1-3 rarely 4 ft. long and 3 to 10 cm. broad, erect, adult ones broadly lanceolate or strap shaped, sometimes the leaf blade showing a tendency to becoming somewhat spirally twisted from right to left towards the apices, but normally with the sides for a foot or more parallel, tapering towards the apices ending into a pale green, leathery, acute, more or less stout, thorny point, and gradually narrowing down to the base into a somewhat concave channelled petiole, conspicuously marked with very closely packed irregular zigzag dark green or paler green transverse bars with creamy yellow, .6 to 1.3 cm. wide stripes and somewhat cartilaginous edges, more or less overspread with glaucous bloom. Scape 1½ to 2½ ft. high, of which 1 to 1½ ft. covered with irregularly scattered flower-clusters bearing generally 3 to 6 flowers, .6 to 3.8 cm. apart. The lower part of the scape passing into 3-5 ovate, lanceolate, acute, pale brown, membraneous sheath, about 7.5 cm. long and 2.5 cm. broad. Bracts .3 to 1.3 cm. long spreading, narrowly ovate lanceolate, acute or slightly acuminate. Flowers 3-8 in a cluster, very pale greenish white or creamy white; 5 to 10 mm. long, joint at or just above the middle with persistent pedicel, 2 to 5 mm. long. Perianth lobes 1½ to 3 cm. long, linear, subacute or sub-obtuse; style 2½ to 3½ cm. long. Fruit a berry, green when immature, yellow when ripe, about 5-8 mm. in diameter. Flowering freely and profusely during cold weather, fruiting a little later.

Habitat.—Tropical Africa.

SOME BIRDS OF CHITTAGONG.

BY

MAJOR R. S. P. BATES, M.B.O.U.

I was in Chittagong from March 5th for exactly three months. Owing to 'terrorist' activities one's movements were somewhat restricted, so the following list is by no means complete. I never got down to the sea-shore which is difficult to reach owing to lack of roads, and in fact with but one or two exceptions all the birds in the list were seen within three miles of my bungalow.

The residential station of Chittagong is built on a series of small pimples up to a couple of hundred feet in height, the end of a low narrow range running northwards parallel to the coast with a wide cultivated plain between it and the Chittagong Hill Tracts which do not concern us here at all. As one gets away from the station, these hills become more and more thickly wooded and the height gradually increases. The maze of narrow long winding nullahs between the wooded hills contains very varied types of country from grass and scanty cultivation to thick bush, and reeds, and canes, into which it is almost impossible to penetrate. Clearings and old tea gardens are also to be met with. This part of the district naturally contains a very varied and interesting avifauna. The flat cultivated areas away from these hills contain little out of the ordinary.

(8) **Corvus levaillanti andamanensis.** Andaman Jungle-Crow. The stout bill is a very noticeable feature of this crow.

(11) **Corvus splendens splendens.** The House Crow of Chittagong is a very dark bird but is apparently 'splendens'.

Dendrocitta rufa. Tree-Pie. Common. A pair in our garden had a young one (I never saw more than one) out of the nest on May 22nd.

(120) **Dryonastes ruficollis.** Rufous-necked Laughing-Thrush. Saw two pairs in the thickets and long grass at the edge of one of the long winding nullahs. One shot on May 26th proved to be a female whose organs were undeveloped. Besides other notes they have a very pleasant three-noted whistle.

Timalea pileata. Red-capped Babbler. A common bird in the hilly tracts. The testes of a male shot on April 12th were slightly enlarged. This bird has some harsh notes which I could not distinguish from the 'korkuch' of the Indian Great Reed-Warbler which is such a feature of every reed patch in Kashmir. Until I had actually run one of the birds to earth producing these notes in a reedy patch near some cultivation, I was convinced that a Reed-Warbler must reside in Chittagong. They have also quite a flute-like little descending trill of about half a dozen notes, a most pleasing effort.

Pellorneum ruficeps. A Spotted Babbler was by no means uncommon on the bush-covered hillsides, chiefly where the higher trees were few and the scrub fairly thick. A pair were often heard in an old tea garden just close to our bungalow. The only one I managed to shoot was unfortunately blown almost to pieces. This was on April 14th. It was a breeding male. The outer webs of the feathers of the sides of the neck and hind neck were more a very dark brown than blackish and the spots on the breast also dark brown, but on the whole it appeared to me to agree with the description of *mandellii*.

(283) **Mixornis gularis rubricapilla.** Assam Yellow-breasted Babbler. Shot a male out of a party in very thick scrub jungle in the hills on May 13th. The testes were greatly enlarged.

(362) **Aegithina tiphia tiphia.** Common Iora.

(403) **Molpastes cafer.** Red-vented Bulbul. Common. A very dark bird generally, so presumably *bengalensis* but I collected no specimens. Nor did I look for nests but came on one with three eggs in the crown of a small palm on a roadside on April 12th. Two days later it had been destroyed.

Otocompsa jocosa. Red-Whiskered Bulbul. Common from the outskirts of the station, being slightly more of a jungle bird than the Red-vented Bulbul. Took a nest of three eggs at the Foy Scheme (waterworks) on April 14th and noted numbers of young about shortly after that date. The nest in question was built into a mass of fallen leaves caught up in a bush about three feet from the ground.

(442) **Brachypodius cinereoventris.** Grey-bellied Bulbul. Two bulbuls of this genus were disturbed in a very damp heavily wooded nullah some three miles outside the station on May 20th. One of them obligingly perched quite close to me for a few moments. It was a grey-bellied bird.

(495) **Saxicola torquata.** Bush-Chat. Not very common when we first arrived. They soon disappeared.

(532) **Phoenicurus ochruros rufiventris.** Eastern Indian Redstart. One or two seen in March on passage, the last being recorded on the 17th.

(558) **Copsychus saularis saularis.** Magpie Robin. Common and breeding freely in March, April and May. Young birds seen in the nest on May 2nd in a Woodpecker's old nesting hole and again on May 18th.

Monticola solitaria. Blue Rock-Thrush. One frequented our compound until April 8th. A number were seen on passage about this time.

(639) **Siphia parva albicilla.** Eastern Red-breasted Flycatcher. Common, leaving about the third week of April.

(693) **Hypothymis azurea styani.** Northern Indian Black-naped Flycatcher. Shot a male in thick low mixed jungle on May 13th; organs considerably enlarged. They were not common.

(719) **Lanius cristatus cristatus.** Brown Shrike. Common and still much in evidence when we left in early June.

(729) **Tephrodornis pondiceriana pondiceriana.** Indian Common Wood-Shrike.

(763) **Artamus fuscus.** Ashy Swallow-Shrike. One only seen cruising round our bungalow on May 20th.

(767) **Dicrurus macrocercus albirictus.** Himalayan Black Drongo. Common. Noticed building operations in progress in a fork of a tall nim tree at the Turtle Tank on April 10th. On April 29th saw two young out of the nest being fed by their parents.

(814) **Orthotomus sutorius patia.** Burmese Tailor-Bird.

(940) **Prinia inornata.** Wren-Warbler. Not particularly common but to be met with on most of the sun-grass covered hillsides. A male and female shot on April 12th had the organs only slightly developed.

(958) **Oriolus xanthornus xanthornus.** Indian Black-headed Oriole. Common.

(964) **Gracula religiosa intermedia.** Indian Grackle. I often saw a pair of these birds in a neglected tea garden in the low hills about three miles north of Chittagong.

(969) **Lamprocorax panayensis affinis.** Tipperah Glossy Stare. Shot an immature bird on May 27th out of a flock of four containing one adult. They were feeding in some tall trees in my compound. The iris was a yellowish red.

(982) **Sturnia malabarica malabarica.** Grey-headed Myna. Common.

(996) **Acridotheres tristis tristis.** Common Myna. Common.

(999) **Aethiopsar fuscus fuscus.** Indian Jungle Myna.

(1004) **Sturnopastor contra contra.** Indian Pied Myna. First noticed building operations on April 11th from which date they were nesting freely.

(1010) **Ploceus atrigula atrigula.** Eastern Baya. This Weaver does not wait for the commencement of the rains in the Chittagong District before commencing to breed. I noted one colony on April 21st which must have been building for some days, and during the next couple of weeks noted numbers commencing operations. Fairly tall palms were most in demand, but I saw two colonies on low leafy trees.

(1020) **Munia atricapilla rubronigra.** Northern Chestnut-bellied Munia. Common both in the cultivated areas and in the jungle. Often seen in quite large flocks, sometimes high up in tall trees, sometimes in the long grass and swampy places. The only nest I noticed was being built in a thorny bush close to a path running through quite thick jungle; date May 13th, but a few days previously I saw one picking up grass in my own compound.

(1097) **Passer domesticus nigricollis.** Burmese House-Sparrow.

(1148) **Riparia paludicola brevicaudata.** Indian Sand Martin.

(1186) **Anthus hodgsoni hodgsoni.** Indian Tree Pipit. There was a sudden influx of these birds on March 12th on passage which lasted to the end of the month.

(1195) **Anthus richardi rufulus.** Indian Pipit.

(1215) **Alauda gulgula gulgula.** Small Indian Skylark.

(1245) **Eremopteryx grisea grisea.** Ashy-crowned Finch Lark. By no means common.

(1250) **Zosterops palpebrosa cacharensis.** Cachar White-Eye.

(1279) **Leptocoma asiatica intermedia.** Burmese Purple Sunbird. Sunbirds were really quite uncommon. The only nest found was on May 26th. The female was sitting on two fresh eggs. The nest was overhanging a small much jungle-covered stream running out of one of the numerous small nullahs through some rice cultivation. It resembled most remarkably the flotsam caught up in flood time on all the canes and brambles around.

(1297) **Dicaeum cruentatum cruentatum.** Indian Scarlet-backed Flower-Pecker. A very common and familiar bird, both in the gardens and out in the jungle.

(1353) **Chrysophlegma flavinucha flavinucha.** Large Yellow-naped Woodpecker. Saw a pair in fairly thick jungle in the low hills two miles out on May 13th. In the setting sun their crests appeared lemon yellow and stood out fanwise from the head.

(1368) **Dryobates macei.** Fulvous-breasted Pied Woodpecker. Seen two or three times in the jungles bordering the Foy Scheme dam.

(1394) **Brachypternus benghalensis.** Golden-backed Woodpecker. Common A pair of these birds were boring a hole in a tree close to a Railway official's bungalow in Chittagong on April 23rd. On its completion however a pair of Common Mynas took possession.

(1432) **Thereiceryx lineatus hodgsoni.** Assam Lineated Barbet. Not very common in the station.

(1436) **Cyanops asiatica asiatica.** Blue-throated Barbet. Only seen in the jungle-covered low hills such as at the Foy Scheme.

(1446) **Xantholæma haemacephala indica.** Burmese Crimson-breasted Barbet. Somewhat scarce.

Cuculus canorus. A Cuckoo of this species was heard calling in a railway bungalow compound on April 23rd.

(1456) **Cuculus micropterus micropterus.** Indian Cuckoo. Excessively common. They started calling in the second week of March.

Eudynamis scolopaceus. Koel.

(1479) **Rhopodytes tristis tristis.** Large Himalayan Green-billed Malkoha. I remarked this bird in the better wooded patches concealing the villages in the cultivated areas as well as in thicker jungle along the hills.

(1489) **Taccocua leschenaulti affinis.** Bengal Sirkeer Cuckoo.

(1491) **Centropus sinensis intermedius.** Hume's Crow-Pheasant. The chuckling laugh is much more frequently indulged in than the hooting note.

(1508) **Psittacula alexandri fasciata.** Indian Red-breasted Paroquet. This very noisy bird is the common Paroquet of Chittagong. Two pairs were noted nesting in holes in casuarinas in the station in April.

(1513) **Coryllis vernalis vernalis.** Indian Loriquet. Common.

(1519) **Coracias benghalensis affinis.** Burmese Roller. Quite common on our arrival in March, but all had disappeared before the month was out.

Merops orientalis. Green Bee-Eater.

(1526) **Merops superciliosus javanicus.** Blue-tailed Bee-Eater. Very common and breeding freely in April and May. An enormous colony, which must have numbered a hundred pairs, was nesting in the face of a sandy cliff close to Sholashahr Railway Station, a suburb of Chittagong.

(1533) **Alcedo atthis bengalensis.** Common Indian Kingfisher. Not very common. This was the only Kingfisher I ever saw along the streams, which were not suitable for the Pied Kingfisher. The main river and its tributaries are tidal for many miles inland, and on the only two occasions I went up by launch I saw no Kingfishers of any kind.

(1551) **Halcyon smyrnensis fusca.** Indian White-breasted Kingfisher. Common in the station and breeding freely in April and May.

Upupa epops. There is no resident Hoopoe in Chittagong. I saw three or four (probably saturata) soon after our arrival i.e. between March 5th and 17th but none after the latter date.

(1599) **Micropus affinis subfuscatus.** Malay House-Swift.

(1600) **Cypsiurus batasiensis batasiensis.** Bengal Palm-Swift.

(1661) **Bubo coromandus coromandus.** Dusky Horned Owl. Common. Their rumbling calls were to be heard in the evenings from every suitable clump of trees. We had a pair in our own compound. In Rajputana these birds called mainly in the rains and breeding season but they were calling all the time we were in Chittagong.

(1684) **Athene brama indica.** Northern Spotted Owlet. Rather uncommon. In fact I only heard them at a small village a mile or so north of Chittagong.

(1689) **Glaucidium cuculoides rufescens.** Burmese Barred Owlet. The common Owl of Chittagong. We had two pairs in our compound on the outskirts.

(1706) **Sarcogyps calvus.** Black Vulture. Quite common.

(1711) **Gyps indicus nudiceps.** Northern Long-billed Vulture. Common.

(1713) **Pseudogyps bengalensis.** Indian White-backed Vulture.

(1730) **Falco chiquera chiquera.** Red-headed Merlin. This bird was quite common in Mymensingh but I only saw it occasionally at Chittagong.

(1780) **Ichthyophaga ichthyaetus ichthyaetus.** Large Grey-headed Fishing-Eagle.

(1784) **Haliastur indus indus.** Brahminy Kite.

(1788) **Milvus migrans govinda.** Common Pariah Kite.

(1792) **Circus cyaneus cyaneus.** Hen-Harrier. The Harriers had mostly left when we arrived in Chittagong, but I saw one Hen-Harrier, a late straggler, on May 1st. The Pied Harrier, still common when we left Mymensingh, was never seen, and the next bird too only a couple of times.

(1794) **Circus aeruginosus aeruginosus.** Marsh Harrier. Last seen on May 2nd.

(1819) **Pernis ptilorhynchus ruficollis.** Indian Crested Honey-Buzzard. Comparatively common. A pair were always hanging about our compound, making their presence known by a high-pitched trisyllabic squeal uttered frequently when on the wing. On one occasion as I drove up to the bungalow, I nearly ran into one as I came over the crest of the hill. It was on the ground busy devouring termites. When the winged swarms appeared they were always much in evidence along with the Common and Brahminy Kites, Mynas and Crows, wheeling to and fro screaming continuously.

(1826) **Crocopus phoenicopterus viridifrons.** Burmese Green Pigeon. Building in March.

(1856) **Columbia livia intermedia.** Indian Blue Rock-Pigeon.

(1874) **Streptopclia chinensis tigrina.** Burmese Spotted Dove. Exceedingly common.

(1900) **Polyplectron bicalcaratum bicalcaratum.** Burmese Peacock-Pheasant.

(1903) **Gallus bankiva murghi.** Common Red Jungle-Fowl. Fairly common all along the hills from the commencement of the forests at the Foy Scheme.

(1921) **Gennaeus horsfieldii horsfieldii.** Black-breasted Kalij Pheasant.

(1997) **Turnix suscitator plumbipes.** Burmese Bustard-Quail.

(2022) **Amaurornis phoenicurus chinensis.** Chinese White-breasted Water-hen. Common.

(2031) **Metopodius indicus.** Bronze-winged Jacana. Very common. Every tank sufficiently weedy had at least one pair.

(2127) **Lobivanellus indicus atronuchalis.** Burmese Red-wattled Lapwing. Only seen once on May 2nd.

(2143) **Tringa ochrophus.** Green Sandpiper.

(2145) **Tringa hypoleucos.** Common Sandpiper.

(2150) **Glottis nebularia.** Greenshank.

(2170) **Capella gallinago gallinago.** Fantail Snipe.

(2173) **Capella stenura.** Pintail Snipe.

(2183) **Anhinga melanogaster.** Indian Darter.

(2218) **Ardea cinerea rectirostris.** Eastern Grey Heron.

(2225) **Egretta garzetta garzetta.** Little Egret.

(2226) **Bubulcus ibis coromandus.** Cattle Egret. Noted to be in breeding plumage on May 2nd.

(2229) **Ardeola grayii.** Indian Pond Heron.

(2237) **Ixobrychus sinensis sinensis.** Yellow Bittern.

(2238) **Ixobrychus cinnamomeus.** Chestnut Bittern. A male shot on May 24th had the testes the size of pea-nuts. It had a slightly digested whole frog in its stomach.

(2292) **Podiceps ruficollis capensis.** Indian Little Grebe.

THE MEDICINAL AND POISONOUS SEDGES OF INDIA

BY

J. F. Caius, S.J., F.L.S.

The Cyperaceae are grass-like herbs broadly distributed all over the world, and especially in the cold regions of the northern hemisphere; they are gregarious in marshy plains, damp meadows, and the dry slopes of high mountains; they are less frequent in maritime estuaries. The family includes 85 genera, with about 2,600 species.

The medicinal and poisonous sedges of the world belong to 11 genera:—Carex (cold and temperate regions); Cyperus (Tropics and Subtropics); Eriophorum (Arctic or Northern temperate regions); Fimbristylis (Tropics); Gahnia (Australasia; from Singapore to the Sandwich Islands); Juncellus (warm regions); Kyllinga (Tropics and Subtropics); Pycreus (warm and temperate regions); Remirea (Tropics); Scirpus (cosmopolitan; as far as the Polar regions); Scleria (moist warm countries).

The medicinal and poisonous sedges of India belong to 7 genera:—Carex, Cyperus, Fimbristylis, Juncellus, Kyllinga, Remirea, Scirpus.

A. Spikelets of few or many glumes; lower 1-2 glumes always empty, uppermost male empty or imperfect, intermediate ones bisexual:	
I. Flowering glumes usually many, all distichous; no hypogynous bristles:	
1. Style bifid; flowers 1 or 2 in spikelet; rhachilla of spikelet deciduous	Kyllinga.
2. Style bifid; rhachilla of spikelet persistent; nut dorsally compressed	Juncellus.
3. Style trifid; rhachilla of spikelet persistent after fall of glumes	Cyperus.
II. Flowering glumes usually many in a spiral; hypogynous scales or bristles often present:	
1. Style-base persistent or completely deciduous; no hypogynous bristles; leafy plants ...	Fimbristylis.
2. Style-base not articulate passing into nut gradually; hypogynous bristles 0-6, undivided, linear, rarely oblong	Scirpus.
B. Spikelets sessile in dense digitate cylindric spikes; glumes 4, 3 empty, uppermost with a perfect flower	Remirea.
C. Spikelets of male or female flowers, or both; nuts enclosed in an utricle entire or 2-fid at the tip only	Carex.

Carex.

This genus includes over 900 species broadly dispersed in cold and temperate regions, a few being found in mountainous tropical regions.

C. arenaria Linn., *C. disticha* Huds., and *C. hirta* Linn. are used medicinally in Europe; *C. macrocephala* Willd. and *C. siderosticta* Hance are similarly used in China.

Carex cernua Boott is found in Assam and extends to Tongking and Japan.

The plant is said to be toxic to cattle producing lack of appetite, loss of milk, and definite nervous symptoms.

CYPERUS.

This genus includes 300 species, natives of tropical and subtropical regions, a few being found in temperate regions. It abounds on the shores of tropical rivers, and in the clearings of virgin forests.

The following species are used medicinally in Europe: *C. esculentus* Linn., *C. longus* Linn., *C. rotundus* Linn.—; in China, Indo-China, Malaya, and the Philippine Islands: *C. rotundus* Linn.—; in West Africa: *C. articulatus* Linn., *C. esculentus* Linn.—; in South Africa: *C. esculentus* Linn., *C. fastigiatus* Rottb., *C. longus* Linn., *C. sexangularis* Nees—; in Madagascar: *C. aequalis* Vahl, *C. alboviridis* C. B. Clarke, *C. esculentus* Linn.—; in Guiana: *C. elegans* Linn.

A. Rhachilla of spikelets not much winged; spikelets spicate or subracemose, linear, 6-20 flowered. Leaves and bracts long ... ... 1. *C. iria.*
B. Rhachilla of spikelets (usually conspicuously) winged:
  1. Tall plants. Stolons long, hardening into creeping rhizomes. Leaves short. Glumes approximate, closely imbricate:
    a. Spikelets shortly spicate, 12-50 flowered ... 2. *C. articulatus.*
    b. Spikelets linear, pale straw-coloured ... ... 3. *C. scariosus.*
  2. Tall or medium plants, stoloniferous or rhizome woody. Leaves and bracts long. Rhachilla of spikelets winged. Glumes closely imbricate:
    a. Stem at base nodosely thickened:
      i. Leaves flaccid, flat; umbels expanded, usually compound ... ... 5. *C. rotundus.*
      ii. Leaves rigid, filiform, or very narrow; umbel simple, compact ... ... 7. *C. stoloniferus.*
    b. Stem at base not nodose:
      i. Stem 6-12 in. high; leaves as long or nearly so 6. *C. esculentus.*
      ii. Stem 12-36 in. high; leaves $\frac{1}{2}$-$\frac{3}{4}$ stem ... ... 4. *C. longus.*
  3. Tall stout plants. Stolons absent. Leaves and bracts long. Umbel large, compound. Spikes and spikelets many. Rhachilla of spikelets conspicuously winged. Anthers apiculate, not rarely crested. Style with its three branches small. Nut small ashy black.
    Spikelets linear subterete suberect dirty straw-colour ... ... 8. *C. platyphyllus.*

1. **Cyperus iria** Linn. is found throughout India and Ceylon in rice fields. It extends to Malaya, Indo-China, China, Japan, Australia, Afghanistan, Persia, the Mediterranean, and tropical Africa.

The plant is tonic, stimulant, stomachic, and astringent.

Among the Mundas of Chota Nagpur the tuber is ground together with that of *C. rotundus*, and drunk in fever.

Bengal: Burachucha—; *Hasada*: Jimtu—; *Hindi*: Burachucha, Nagarmotha—; *Lao*: Yak dan din—; *Malay*: Rumput tuloh belalang—; *Mundari*: Huringloeongjimtu, Loeongjimtu, Loeongjintu—; *Naguri*: Jindu—; *Rajputana*: Moth—; *Sinhalese*: Welhiri—.

2. **Cyperus articulatus** Linn. occurs from Bengal to Ceylon on the banks of rivers and lakes. It inhabits the tropical and warm regions of both hemispheres.

The tuber is a good tonic and stimulant. It is used medicinally in Hausaland.

Arabic: Chasegj—; *Betsimisaraka*: Mita—; *Egypt*: Goreyb—; *Guinea*: Gorhe, Madia—; *Kanuri*: Kajiji—; *La Reunion*: Jambelon—; *West Indies*: Adrue—.

3. **Cyperus scariosus** Br. is found in Bengal and Pegu, and extends thence to Australia.

The root is recognized by both Ayurveda and Yunani. Hindu writers describe it as pungent, acrid and cooling; promoting the flow of milk; regulating the bodily temperature by its antipyretic and sedative action; useful in the treatment of biliousness, fever, dysentery; relieving thirst, fatigue, burning sensations, and bad taste in the mouth.

Mohammedan authors qualify the taste of the root as bitter, hot, and unpleasant. As a drug it relieves flatulence, stimulates the menstrual discharge, enriches the blood, and improves the appetite; it also checks abnormally profuse menstruation and urination; it is useful in the treatment of stuttering, offensive discharge from the nose, eye sore, brain and chest troubles, piles, swellings, lumbago, and scorpion sting.

In practice the root is considered cordial, stomachic, and desiccant; also diaphoretic and diuretic. A decoction is used in gonorrhoea and in syphilitic affections; and it has been found useful as an astringent in diarrhoea.

In cases of epilepsy the root is given in combination with valerian.

Caius and Mhaskar have shown experimentally that the drug is not an antidote to scorpion venom.

Arabic: Soad, Soadekufi—; *Bengal*: Nagarmutha—; *Burma*: Vomonniu—; *Canarese*: Konnarigadda, Nagarmusthe—; *Deccan*: Nagarmotah—; *Gujerati*: Nagaramothya—; *Hindi*: Nagarmotha—; *Malayalam*: Korakizhanna—; *Marathi*: Lawala—; *Persian*: Mushkezamin—; *Sanskrit*: Chakranksha, Charukesara, Chudalapindamusta, Kachharuha, Kalapini, Nadeyi, Nagarmusta, Nagarotha, Shishire, Vrishadhmankshi, Uchchta—; *Tamil*: Koraikilangu—; *Telugu*: Kolatungamuste, Tungagaddalaveru—; *Urdu*: Nagarmotha—.

4. **Cyperus longus** Linn. occurs at Quetta and Mount Abu. It extends westwards to the Atlantic.

The bitter aromatic tuber is used in Spain as a stimulant, stomachic, and emmenagogue.

The Zulus prepare an enema from the tuber for children with stomach troubles. They also blow the powdered tuber into the nose and ears for colds and other troubles in these regions, and the tuber may be chewed for the same purposes.

At Filabusi in Southern Rhodesia the juice of the plant is regarded as being very poisonous and is said to burn the skin when applied to it.

Catalan: Castanyola—; *Chinese*: Hiang Fou Tzeu—; *Egypt*: Sa'ad—; *Filabusi*: Mlabie—; *French*: Souchet long, Souchet odorant—; *Italian*: Giunco odorato—; *Spanish*: Juncia olorosa—.

5. **Cyperus rotundus** Linn. is common in waste grounds, gardens, and roadsides in open spots. It is found throughout India and Ceylon, and in all warm parts of the world.

Ayurvedists describe the root as pungent, acrid, cooling, astringent, bitter, stomachic, and anthelmintic. It restores lost appetite, and is useful in leprosy, thirst, fever, diseases of the blood, biliousness, dysentery, intense itching, pain, vomiting, epilepsy, ophthalmia, and erysipelas.

According to Arabian and Persian writers the root is attenuant, diuretic, emmenagogue, diaphoretic, anthelmintic, and vulnerary. They recommend it for the treatment of ulcers and sores, fevers, dyspepsia, and urinary calculus. They prescribe it in large doses as an anthelmintic.

The roots are commonly used as a diaphoretic and astringent. They are also credited with stimulant and diuretic properties. They are held in great esteem as a cure for disorders of the stomach and irritation of the bowels. They are scraped and pounded with green ginger and, in this form, mixed with honey, they are given in cases of dysentery in doses of about a scruple, and are said to have been given with benefit in cholera. They are used too as a worm remedy. In the Philippines the bruised root is applied to the face for toothache.

In the Konkan the fresh tubers are applied to the breast to stimulate the flow of milk. In Chota Nagpur a decoction is used in fever.

In Malaya the tubers are smoked in cases of pain in the nose. In Cambodia they are a common remedy for fever and retention of urine.

According to the Chinese the small tubers act on the lungs and liver. Their general action is tonic, stimulating and stomachic.

In Ceylon a decoction is given in fever, diarrhoea, dyspepsia and stomach complaints.

The tuber is an Ayurvedic medicine for snake bites and scorpion stings; but Mhaskar and Caius have demonstrated that it is useless in the treatment of either snake bite or scorpion sting.

Sanjiva Rao, Panicker and Sudborough have studied the chemical composition of the essential oil from the tubers, but have not been able to isolate any pure substances from it (1925). Further work (1928) by Kimura and Ohtani does not throw any light on the therapeutic properties of the drug.

Annam: Cu co, Huong phu—; *Arabic*: Suad—; *Australia*: Yelka—; *Bengal*: Ghun, Motha, Mutha, Nagurmotha—; *Bicol*: Botobotones—; *Bombay*: Barikmoth, Musta—; *Cambodia*: Kravalchruk, Kravanhchruk—; *Canarese*: Tungegadde—; *Chinese*: Houi T'eou Ts'in, Hsiang Fu, So Ts'ao—; *Deccan*: Korekijhar—; *Egypt*: Burbeyt, Dis, Negil, Sa'ad, Sa'ad-el-homar, Sibl-el-ma'iz—; *English*: Nut Grass—; *Guam*: Chaguan, Humatag—; *Gujerati*: Motha—: *Hamadan*: So-ad—; *Hasada*: Sunumsangga—; *Hausa*: Ayaaya—; *Hindi*: Ghun, Motha, Mutha, Nagurmotha—; *Ho*: Rotesila—; *Iraq*: Ghusainiyah, Sa'ad, Su'aid, Sijil—; *Japan*: Hamasage, Kobushi—; *Kut*: Ghusainiyah—; *Lao*: Ya m'niu mu—; *La Reunion*: Oumine—; *Malaya*: Heong foo, Rumput haliva hitam—; *Marathi*: Bimbal, Motha—; *Mundari*: Bathabijir—; *Naguri*: Mothatasad, Pirjimtu—; *Nasirabad*: Kabb—; *New Caledonia*: Jilio—; *Pampangan*: Cusung, Galonalpas, Malaapolid, Mota, Omading, Omadiung, Onoran, Sursur—; *Persian*: Suad, Su'd, Muschk-i-zemin—; *Sadani*: Mothaghas—; *Sanskrit*: Abda, Arnoda, Bhadrakshi, Bhadramusta, Gangeya, Granthi, Gundra, Hima, Kachhola, Kakshottha, Kasheru, Krodeshtha, Kuru, Kurubilva, Kutannata, Musta, Mustaka, Sugandhigranthila, Valya, Varahi, Varida, Vindakhya—; *Santali*: Tandisura—; *Sinhalese*: Kalanduru—; *Sokoto*: Girigiri—; *Spanish*: Juncia redunda—; *Sudan*: Seid—; *Tagalog*: Mutha—; *Tamil*: Kora, Korai—; *Telugu*: Bhadramuste, Gandala, Kaivartakamuste, Mustakamu, Shakhatungaveru, Tungamuste—; *United States of America*: Nut Grass—; *Uraon*: Utrubanda—.

6. **Cyperus esculentus** Linn. inhabits the Upper Gangetic Plain and is found scattered from the Punjab to the Nilgiris and Anamalais. It is distributed over Southern Europe, Africa and America.

According to Ayurveda the tuber is cooling, sweet, acrid; galactagogue, astringent to the bowels, aphrodisiac; sharpens the appetite and improves the taste; useful in eye troubles, burning sensations, and leprosy; disturbs both heat production and heat regulation in the body.

The juice expressed from the tubers is used as an aphrodisiac in Sierra Leone and on the Gold Coast. In Guinea the tubers are given as a cooling drink; the leaves are applied topically for headache.

The root is an Egyptian remedy for colic and hypochondriasis.

The Zulus chew portions of the root for the relief of indigestion, especially when this condition is accompanied by foul breath. Zulu girls, with a view to hastening the inception of menstruation, eat porridge in which a handful of the boiled roots has been mashed.

In Madagascar the tuber is used as a stimulant and aphrodisiac.

The tubers are used as a vegetable in Southern Europe, and Northern and Southern Africa, and, after roasting and grinding, as a substitute for coffee and cocoa. They contain fatty acids, sucrose and starch; but no alkaloid, caffeine or asparagin.

Ada: Fie—; *Afrikaans*: Euntjie, Hoenderuintjie, Uintjie—; *Catalan*: Chufa—; *Egypt*: El-aswad, Es-sogheyyer, Habb-el-'aziz, Habb-el-'azizza, Sa'ad—; *English*: Chufa, Earth Almond, Ground-almond, Nut Sedge. Rush Nut, Tiger-nuts, Zulu Nut—; *Ewe*: Fie, Fio—; *Fanti*: Atadwe—; *French*: Souchet comestible. Souchet sultan, Souchet tubéreux, Trasi—; *French West Africa*: N'ton—; *Fufulde*: Watuje—; *Ga*: Atangwe—; *Greek*: Kiperos—; *Hausa*: Aya—; *Hindi*: Chichada—; *Hova*: Karepoka—; *Krevi*: Fio—; *Krobo*: Fai—; *Madagascar*: Karekika—; *Malinke*: Toki—; *Malta*: Babbagiggi, Chufa, Dolcichini, Edible Rushnut. Habbghaziz—; *Punjab*: Dila, Kaseru—; *Sanskrit*: Kaseruka, Kshudramusta, Sugandhi. Sukanda, Sukareshta—; *Spanish*: Chufa, Juncia avellanada—; *Transvaal*: Einches—; *Twi*: Atadwe—; *United States*: Chufu—; *West Africa*: Rush Nut, Tiger Nut—; *Zulu*: inDawo—.

7. **Cyperus stoloniferus** Retz is found on the shores of India, especially in sea sand, from Sind to Ceylon, Coromandel and the Malay Peninsula. It has also been found in the Nilgiri Mountains. It is common in Malaya where it is found in the sandy sea shores, and in tidal mud: in the former short and wiry, in the latter taller and longer-leaved. It is distributed to China, Australia and Mauritius.

The scented tuber is reputed stomachic, and considered a good stimulant for the heart.

Persian: Mutransialian—; *South India*: Jatamansi—.

8. **Cyperus platyphyllus** Roem. and Schult. occurs in the Deccan Peninsula and in Ceylon.

The tuber is said to be tonic and stimulant.

Fimbristylis.

This genus consists of 225 species, chiefly tropical.

Fimbristylis junciformis Kunth occurs throughout India from Kashmir to Madras and Pegu, up to altitudes of 1,500-5,000 ft. It is also found in the islands of Ceylon and Madagascar and the Philippines.

The Santals use the root in dysentery.

Santali: Bindimuthi—.

Juncellus.

The genus numbers about 20 species inhabiting all warm regions.

Juncellus inundatus C. B. Clarke is frequent in swamps, from Sylhet to the sea. It extends to China.

The tubers are used as a tonic and stimulating medicine.

Bengal: Pati—; *Hindi*: Pati—.

Kyllinga.

This genus includes 50 species inhabiting tropical and subtropical regions.

K. odorata Vahl is used medicinally in Brazil.

A. Nut-bearing glume winged in upper half of keel ... 1. *K. monocephala.*
B. Nut-bearing glume not winged in the upper half of its keel:
  1. Rhizome practically absent ... ... 2. *K. triceps.*
  2. Rhizome elongate ... ... 3. *K. brevifolia.*

1. **Kyllinga monocephala** Rottb. is found throughout India and Ceylon, generally growing in the shade. It is very common in the waste grounds and along the roadsides of Singapore and other parts of the Malay Peninsula. It occurs in the hot and warm regions of the Old World, except the Mediterranean.

The root is a popular cooling medicine much used in fevers. It is often used in the same way and for the same purposes as that of *K. triceps.*

The herb is used as an antidote in many parts of India; but Mhaskar and Caius have shown that it is not an antidote to either snake venom or scorpion venom.

Bengal: Nirbishi, Svetagothubi—; *English*: Button Sedge—; *Guam*: Botoncillo, Chaguan lemae—; *Hawaii*: Kaluja—; *Hindi*: Nirbishi, Swetgothubi—; *Malay*: Rumput butong—; *Malayalam*: Mottenga, Pimottenga—; *Marathi*: Mustu—; *Pampangan*: Malaapolid—; *Sanskrit*: Musta, Nirvisha—; *Tagalog*: Anuang—; *Visayan*: Barubatones, Barubotones, Bolobotones, Borobotones, Bosicad, Botonsilo, Malabotones, Mutha, Sudsud, Tobotobolangit—.

2. **Kyllinga triceps** Rottb. is to be found in Sind, Gujerat, Deccan, Konkan, the Southern Mahratta Country, the North-West Provinces, Rajputana, Burma, Ceylon. It extends to China, North Australia and Africa.

The herb is an Ayurvedic drug described as bitter and cooling, good against infection or poison, useful in healing wounds and regulating the heat of the body, valuable in the treatment of nervous troubles and of diseases of the blood.

In Malabar a decoction of the roots is used to relieve thirst in fevers and diabetes. Oil boiled with the roots is used to relieve intensive itching of the skin.

The roots yield an essential oil which is used to promote the action of the liver and to relieve thirst in fevers and diabetes.

Bengal: Nirbishi, Svetagothubi—; *Hindi*: Nirbisi, Shwetgothubi—; *Malayalam*: Mottenga, Pimottenga—; *Marathi*: Mustu—; *Sanskrit*: Apavisha, Avisha, Nirvisha, Vishabhava, Vishaha, Vishahantri, Vishavairini, Vivisha—.

3. **Kyllinga brevifolia** Rottb. is common throughout India, Ceylon and Malacca. It is common on roadsides and waste ground in the Malay Peninsula. It thrives in all warm regions, except the Mediterranean.

The Malays use the rhizome for poulticing sore legs.

Malay: Rumput tuki—.

REMIREA.

The only species of this genus, **R. maritima** Aubl., is found on all tropical sea-shores. It is common in sea-sand in Canara, Tenasserim, the Malay Peninsula, the Nicobars, Ceylon. It is very common in tropical America.

The stock is astringent and diuretic. An infusion of the root is given as a sudorific and diuretic in Brazil and Guiana.

Betsimisaraka: Bararatandriaka—; *Brazil*: Paratura—; *French Guiana*: Remire—.

SCIRPUS.

The genus includes about 200 species, dispersed all over the world, as far as the Polar regions.

S. lacustris Linn. is used medicinally in Europe, *S. maritimus* Linn. in China, *S. cernuus* Vahl and *S. paludicola* Kunth in South Africa.

A. Nut marked with transverse wavy lines; hypogynous bristles absent:
  1. Spikelets in a single lateral dense head ... 1. *S. articulatus.*
  2. Spikelets clustered in rays of a lateral umbel ... 2. *S. corymbosus*
B. Nut not marked with transverse wavy lines; hypogynous bristles present:
  1. Glumes 2-fid at the apex:
    a. Stems cylindrical. Rhizome thick ... ... 3. *S. lacustris.*
    b. Stems trigonous. Rhizome with tuber-like round swellings ... ... 4. *S. maritimus*
  2. Glumes not 2-fid at the apex ... ... 5. *S. grossus.*

1. **Scirpus articulatus** Linn. is found throughout India from the Himalaya to Ceylon and Moulmein, ascending up to 3,000 ft. It extends to the Philippine Islands, Australia and Africa.

The plant is used as a purgative.

Bengal: Putputichechka—; *Hindi*: Chichora, Patpatichechka—; *Telugu*: Luttipittaalli—.

2. **Scirpus corymbosus** Heyne occurs in Western India, Mount Abu, Goonah, Jubbulpore, Hyderabad and Bangalore. It is also found in Africa and Madagascar.

In South Africa it is suspected to be poisonous to cattle.

3. **Scirpus lacustris** Linn. is to be found in Kashmir and Ladak reaching altitudes of 4,500-5,000 ft., also in Muneypore. It is distributed over Europe, Africa, Australia and North America.

The stock is astringent and diuretic.

French: Jonc des chaisiers, Jonc d'eau, Jonc d'étang, Scirpe des marais—; *Madagascar*: Sabotraka, Savotraka—; *Malta*: Bass, Common Bulrush, Giunco di palude—.

4. **Scirpus maritimus** Linn. is found from Kashmir, Kashgar —10,000 ft., and Moradabad to Mysore and Malabar. It is distributed all over the Old World and is represented by varieties in Australia and America.

The root is used in China as an astringent and diuretic.

Chinese: Ching San Ling—; *Egypt*: Debshe—; *Malta*: Sea-side Clubrush, Spurt Grass, Mosca, Erba nocca—; *Nasirabad*: Kab—; *Punjab*: Dila, Murak—; *Sibi*: Kab—.

5. **Scirpus grossus** Linn. fil. occurs throughout India with the exception of the North-Western area. It is found from Sind and Assam to Ceylon and Malacca, extending to the Malay Islands, Cochinchina and Indo-China.

According to Ayurveda its properties are the same as those of *Cyperus esculentus*.

Yunanists describe the root as slightly sweet, cooling, laxative, tonic to the liver, good against infection and poison, diuretic; useful in burning sensations, vomiting, diarrhoea, fever, and gonorrhoea.

The root has astringent properties and is given to check diarrhoea and vomiting.

Bengal: Kasura, Kesari, Kesor, Kesur—; *Bombay*: Kachera—; *Hindi*: Kasuru, Kesur—; *Malay*: Rumput mendarong, Rumput murong, Rumput musiang—; *Marathi*: Kasara—; *Mundari*: Jomekesari, Kesari, Khesari, Marangkesari—; *Sanskrit*: Gundakanda, Kaseru, Kaseruka—; *Telugu*: Gundatungagaddi—; *Uraon*: Kesari—; *Urdu*: Kaseru—.

REVIEWS.

I. POPULAR HANDBOOK OF INDIAN BIRDS. By HUGH WHISTLER, F.Z.S., M.B.O.U. Second Edition. Illustrated. Gurney & Jackson, London (1935). Price 15 shillings net.

Lovers of Indian bird-life will welcome the appearance of the second—revised and enlarged—edition of this useful volume, first issued in 1928 and reviewed on page 180, vol. xxxiii of the *Journal*. As most of the outstanding features of the work have already been commented on by the previous reviewer, it is only necessary now to indicate wherein the present volume differs from its predecessor and to what extent the criticisms then made have been met.

As against the 17 full page plates (81 figures) including 4 in colour, and the 85 text-figures of the first edition the present work contains 20 full page plates (95 figures) of which 5 are coloured, and 96 figures in the text. The number of pages in the present edition is 513 as against the previous 438, while for the 250 species described at length before there are now 275 besides which 230 species are mentioned in short paragraphs giving the salient points in their description and distribution. Most of the commoner birds of the vast Indian Empire thus find a place in the present volume. The text has been carefully revised and brought in line with the advances made by Indian ornithology during the last few years.

The criticism on the first edition—partly justified—that it dealt very largely or more or less exclusively with the birds of North-West or Western India no longer holds, and though the author fully realises the impossibility of any two opinions agreeing as to which are and which are not amongst the really 'common' birds of India, he has succeeded remarkably well in making the selection as representative as possible.

Sizes of birds given in inches, as is the case in the present volume, convey extraordinarily little to the man in the street. We would have liked the sizes expressed in some more intelligible form e.g. by comparison with some of our commonest species such as Crow, Myna, Bulbul, Sparrow and others. A table of measurements of these 'standards' at the beginning of the book might have helped the reader to get a better idea of the figures where they appeared in the text. Personally we also think—and perhaps many may not agree—that the time is long past when even in popular ornithological works the use of the inch as a unit of measurement should be encouraged. In view of present-day methods and tendencies and of the universal recognition of geographical races, it seems to us necessary and desirable that ornithologists should grow up with their ideas of size in millimetres rather than in inches and their cumbersome fractions. Therefore, *if* measurements are given at all they should, to be of any value, be expressed in the metric system. It is only fair to mention, however, that in the present instance these points have not been overlooked by the author. He weighed them carefully but finally came to the conclusion that as the measurement of length is practically valueless except to the 'popular' observer, it might be as well to give it in inches since they are familiar to him, and even the most lay can hold his two forefingers up and say 'That is about six inches'.

Inspite of the increase in bulk and contents it is gratifying to note that the old price has been maintained. The book in its present form is all that the average bird-lover can desire and, as it fills a very distinct niche in Indian natural history literature, we can confidently predict the same popularity for it as was enjoyed by its predecessor.

S. A. A.

II. TIGER UND MENSCH. By BENGT BERG. 9½"×7". 187 pages, 63 plates. Dietrich Reimer/Ernst Vohsen, Berlin (1935). Price, 4.80 R.M.

On the continent of Europe the name of Bengt Berg is synonymous with superbly illustrated books on natural history. He enjoys the reputation of being one of the foremost nature photographers and has a style of writing that goes direct to the heart of the nature lover. Both these qualities reflect directly upon the popularity of his wide and ever-increasing range of books, many of which have run into several editions and to between twenty-five and thirty-seven thousand copies each.

The earlier publications on which rests the fame of Bengt Berg concerned themselves mostly with birds, but spurred no doubt by his achievements and by the possibilities he discovered when in India some years ago to make photographic records for his book *Der Lämmergeier im Himalaya*, he has of recent years taken to photographing the wild animals of the Indian jungles. His magnificent studies of the Rhinoceros (*R. unicornis*) in Bengal may be seen in his book *Meine Jagd nach dem Einhorn*, published in 1932 or thereabouts.

The present book, dealing principally with the tiger, is evidently written for stay-at-home foreigners who have only seen the animal behind bars in a Zoo, and have at best somewhat hazy and fantastic notions regarding its life and habits. While it contains nothing that can be called startlingly original or which cannot be found in any good book on Indian natural history, some of the points dealt with are of more than usual interest and reflect keenly on the author's powers of observation. As the book is in German and may not be intelligible to many of our readers, it may perhaps be desirable to touch on some of its contents briefly, though this must necessarily be in rather disjointed fashion.

Doubt is cast by the author on the customary explanation for striped and spotted colouration that it is protective or obliterative in a jungle environment, since most of its possessors move about chiefly in the dark when there is no sunshine through the foliage or the grass and reeds to render the colouration advantageous. It is stressed, however, that spotted or striped colouration is most obliterative in moonlight.

It is suggested that the fact of there being so many more tigresses than tigers may be accounted for by the probability that adult males kill off their male descendants as soon as the latter start coming into direct competition with them. The Maharajah of Alwar, who is said to possess an incomparable knowledge of the tiger of his part of the country, assesses the proportion of tigers to tigresses as 1:5. In Alwar it appears that only tigers are shot and tigresses spared, which may account for this great disparity, but even elsewhere the proportion of the sexes is unequal. The author believes that the tiger is polygamous and claims to have studied the relations of the sexes first hand when after them for photographing purposes. The tiger is said to visit successive females in different areas or valleys, may be 10 or 15 kilometers distant from one another. Their wooing and courtship ceremonials as read from the spoor of a pair are described, and at page 59 a photograph is given of the impression in the sand on a stream bank where copulation had taken place.

A story retailing the steps that lead up to the making of a man-eater is rather well told, and the photograph accompanying it of a tigress slinking downhill through bamboo jungle is a particularly lifelike one.

The author agrees with most sportsmen in considering that Kipling is wrong in giving a better character to the panther in the *Jungle Book* than to the tiger.

The economic usefulness of the tiger is indicated by the statement that in many places where tigers have been shot out, jungle villages have had to be abandoned owing to the enormous increase in pigs and deer which rendered agriculture impossible. Many aboriginals are said to exist solely on food obtained from tiger kills through following the movements of vultures.

The correctness of the huge annual mortality statistics, officially attributed to tiger, panther and other wild animals is questioned. The author thinks they may be due to incorrect information supplied by petty officials, as whenever any unaccountable disappearance or death takes place in a village, it is either attributed to tiger or panther, or in their absence to cobras.

The comparative risks involved in following up wounded animals is discussed. Tiger and lion are given first place on account of their powers of concealment and of making themselves invisible coupled with their extreme vitality—even when mortally wounded—and the septic nature of their bites and mauling. Owing to the wooded character of the tiger's terrain as compared with the lion's, the former is considered far more dangerous and the relatively greater casualties among tiger hunters is cited as evidence of this.

The various methods of hunting tiger in India—machans, beats, etc., are described.

The author estimates—on what grounds we are not told—that the Hyderabad State may contain from five to six hundred tigers. Far behind come three or four States with half that number, and after these 50 to 150 tigers can be reckoned in each of the better-known tiger hunting States. He guesses that Nepal has probably not more tigers than Hyderabad. It is observed that their tiger population is an asset to the princes, not so much for their own sport as for entertaining distinguished guests with. 'Whoever in India can present a highly placed guest with a tiger, has a trump card in his hand which puts every other in the shade.' One Maharaja said to the author about his neighbour: 'A fine State and an excellent administrator, but' (this with a satisfied chuckle) 'he has no tigers!'

Some shrewd remarks concerning the shoots of distinguished guests in Indian States, the arrangements made for them and the measuring of tigers shot by the great ones show keen insight on the author's part. He has, however, great praise for the sportsmanship of the Indian princes. The Maharaja of Rewa is said to have shot over 600 tigers and hopes to complete his 1,000 some day.

There follows an extraordinary story of a vendetta between Bani Singh (a 'Bengali'!) and Yat Aung, a Burman, where the former is forcibly, and through an artifice, tied up as bait for a man-eating tiger. It is a bizarre and hair-raising episode graphically told, and remarkable, if true.

The facsimile reproduction of a letter from the Divisional Forest Officer, Nimar Division, testifying to the fact that the author's wife sat up alone in a machan one night and shot two tigers seems to us somewhat superfluous, but it perhaps carries its appeal to foreign readers!

The last chapter deals chiefly with the Rhinoceros (*R. unicornis*) and its present position in Bengal where it had recently reached the point of extinction at the hands of roving bands of poachers backed by Chinese gold. The author, by his book *Meine Jagd nach dem Einhorn*, claims to have roused the interest which culminated in the protective measures that have since been enforced. We are constrained to challenge this claim as extravagant, and not only unfair to Shebbeare, the Chief Conservator of Forests, Bengal, who has been the prime mover in this matter for years, but also an insult to the Forest Department and to the various bodies that have been striving in the interests of Wild Life Conservation in India.

Bengt Berg photographed a rhino calf three years previously and the same animal (distinguished by an old wound-mark) again in the same spot on his last visit. He observes that unlike elephants, the rhino remains constant to its haunts, a factor which facilitates its destruction by poachers, but at the same time simplifies the question of its supervision by game watchers.

Particular interest attaches to this book in view of the somewhat warm discussions that have recently taken place in the Miscellaneous Notes section of the *Journal* regarding the ethics of flashlight photography. The objection raised was that the methods employed by Bengt Berg (for his identity can no longer remain concealed) in photographing wild animals at night were reprehensible and unsportsmanlike. What this gentleman apparently did in India was to plaster the jungle, especially the vicinity of water-holes, etc., with a number of automatic cameras worked by trip-wires running across the beaten tracks of animals. When the wire was tripped, the flash went off with the report of a hand-grenade and, being synchronised with the shutter, resulted in the animal photographing itself. It was contended that a number of such explosions going off in the course of a night had the effect of scaring away wild animals and speedily clearing the neighbourhood of game. If such methods of photographing were indulged in solely with the object and under the name of 'sport', we would join forces with the critics to condemn them whole heartedly. Fortunately, by virtue of the cost of such outfits and the expense of working them, it is unlikely that Bengt Berg's methods will ever become a serious menace to wild life in India. In the author's case, we think it is patent that he was not indulging in this pastime for the sake of sport alone. He was plainly doing it to obtain material for his books, one of which we have before us now, and naturally he wanted the maximum of results in the minimum of time. Illustrated books of this kind are all too few in India not to be welcomed whenever they appear, and considering that they help, as little else can, in arousing interest in wild life and creating public opinion in its favour—vital to the success of any efforts at conservation—we are of opinion that some slight indulgence is called for of means that justify the end so admirably, especially as they result in no *permanent* harm to wild life. It will be realised by all, of course, that a thing of this sort can very easily be overdone and therefore, as a general practice, it is one to be discouraged.

The reproduction of the photographs does full justice to their charm and exquisiteness, and the printing of blocks on both sides of a sheet, has in our opinion, not detracted in any way from the artistic quality of the work as has been claimed by the publishers of two well-known books of the kind in England. An agreeable feature of the volume is its very modest price, equivalent at the present rate of exchange to about five rupees; this is a factor that must tell a great deal on its circulation under present economic conditions.

It is rather a pity that the letterpress should have been in the ornate Gothic type and not the clearer, easily-read Roman as has lately been the tendency in Germany to adopt. But this reversion may perhaps be part of the Hitlerian campaign for purification of Nordic institutions !

The excellent photographs alone entitle the book to a place in every nature lover's library.

S. A. A.

III. ZUR KENNTNIS NORDOSTASIATISCHER VÖGEL: Ein Beitrag zur Systematik, Biologie und Verbreitung der Vögel Kamtschatkas und der Kurilen. By Sten Bergman. Paper cover 10″×8″; 268 pp.; 2 maps; 16 plates. Albert Bonniers Förlag, Stockholm (1935). Price, 20 Kronor.

This volume embodies the results of the author's two ornithological expeditions, the first to the Kamtschatka Peninsula (1920-22) and the second to the Kuril Islands (1929-30) north of Japan.

The expeditions were financed by the Swedish Academy of Sciences, the Swedish Anthropological and Geographical Society and by other institutions and private persons. One of the latter, being a ship-owner, provided free transport to the members of the first expedition and their baggage to and from Japan, a form of public spiritedness that may well be emulated by our own shipping magnates and railway authorities in India !

The collections made by the expeditions were worked out by the author at the Natural History Museum, Stockholm, with the collaboration of such eminent authorities as Prof. Dr. Einar Lönnberg, Prof. Dr. Hialmar Rendahl and Dr. Nils Gyldenstolpe. The Leningrad Museum was also visited in this connection and we find the help of the late Prof. P. Suschkin and of the present director of the Bird Department, Dr. B. Stegmann, acknowledged. The material from Kamtschatka was partly sold and partly presented to the Stockholm Museum, while that from the Kuril Islands, which was richer both in species and in specimens, was presented by the author to the same institution.

A comprehensive history of ornithology in Kamtschatka and the Kurils is followed by geographical and topographical notes on the Peninsula and Islands, also some data as regards vegetation and climate. Then comes a short account of the author's itinerary on the two expeditions which is succeeded immediately by the systematic lists, arranged in separate sections, and containing some good field notes. Unfortunately we find no separate section dealing with Migration which would have added very considerably to the usefulness of the work as far as we in India are concerned. Since the author was in Kamtschatka continuously for three summers and two winters, he must have had the opportunity for accumulating ample data bearing on this subject. The times of arrival and departure of migrants are, however, briefly mentioned under individual species.

To us in India the greatest interest in the book lies in the fact that many of our winter visitors, especially to Assam and Burma, but also to Ceylon and the eastern side of the peninsula, come from round about the parts dealt with therein. Of the 133 forms listed from Kamtschatka we notice that 42 are cold weather visitors to the Indian Empire, while of the 144 forms from the Kurils we receive no less than 47. Many of these birds breed in the Kamtschatka Peninsula and/or the Kuril Islands, but others merely pass through on their way to and from their breeding grounds still farther north.

It is good to find that wherever a race is listed which has at some time or other been described as a novelty by the author himself, the reference and original description is quoted in extenso making it convenient for workers who cannot have access to all the journals—mostly Swedish—in which they were first published.

The fact that specimens of *Muscicapa latirostris* from the southern Kuril Islands in the proximity of northern Japan, have been determined as belonging to the typical race, *latirostris* Raffles, and not to *poonensis* Sykes which according to the *Fauna* (vol. ii, p. 249) they should be, would appear to support the contention of Messrs. Whistler and Kinnear (*J.B.N.H.S.*, vol. xxxvi, p. 86) that this Flycatcher has no races—at any rate that *poonensis* of the *Fauna* cannot be recognised. The measurements given by Mr. Bergman for his Kuril specimens (3 ♂♂ wing 70-72 mm., 4 ♀♀ wing 68.5 mm.) certainly agree well enough with birds from Sumatra etc. (*latirostris* according to the *Fauna*) as well as with those from the plains of India and also again with the measurements given by Mr. Stuart Baker for birds from 'Japan to the Himalayas' (i.e. his *poonensis*).

The photographs—32 in all—of topographical, vegetational and avian subjects are excellent, and the extensive and useful bibliography at the end of the book adds considerably to its value as a work of reference.

S. A. A.

IV. LAC AND INDIAN LAC RESEARCH INSTITUTE. By Dorothy Norris, P. M. Glover and R. W. Aldis. (Calcutta, 1934. Price Rs. 2-8.)

The Indian lac industry was greatly affected by the war, as it not only altered the value but also the direction of the lac trade. The lac, as is well known, is virtually an Indian monopoly, and its high price during and after the war greatly stimulated the manufacture of synthetical rival products. The Government of India fearing the fate of the Indigo industry appointed a Commission to investigate the conditions of the industry and make recommendations for safeguarding it. The report of the Commission was issued in 1921, and as a result in 1925 the Indian Lac Research Institute was founded with its headquarters at Namkum, Ranchi (Bihar and Orissa).

The work under review after briefly surveying the Indian lac industry, in which is included its early history and its entomological aspect, gives an account of the areas of major importance in lac cultivation and the uses of shellac. The synthetic substitutes of lac are discussed in detail, and a short chapter is devoted to the necessity for research. The foundation and work of the Lac Research Institute at Namkum are discussed in detail in a later chapter. In connection with the latter a full account is given of the biochemical, chemical, physio-chemical and entomological research at the Institute. A detailed bibliography is added and a glossary explaining the terms used in the work is appended. Detailed statistics of lac production in Assam, Burma and countries outside India are also given and the question of the future of the lac industry in the country is discussed in detail.

The work, which is well written and fully illustrated, is very opportune and should serve as a work of reference hereafter.

B. P.

V. THE FAUNA OF BRITISH INDIA, INCLUDING CEYLON AND BURMA. Reptilia and Amphibia. By Malcolm A. Smith. (Vol. II. *Sauria*, pp. i-ix, 1-440, 1 pl., 2 maps, text-figs. February 1935, London.) Published under the authority of the Secretary of State for India in Council and edited by Lt.-Col. R. B. S. Sewell, F.R.S. Taylor and Francis, 30 shillings.

In my review of the first volume of the series (*Journ., Bombay Nat. Hist. Soc.*, xxxv, p. 881, 1932) attention was directed to the great improvement effected by Dr. Malcolm A. Smith in his revision of a part of Boulenger's work published in 1890. The same high standard has been maintained in the treatment of lizards, which form the subject matter of the second volume.

In the introduction the author gives a short but succinct account of the structure of the animals, with particular reference to the skin, the teeth, the salivary glands, the tongue, the cloaca, the femoral glands and the eggs. The changes in colour and colour-patterns are briefly described and a note on the fragility of tail is also added. The phenomena of evolution and devolution are illustrated by reference to the diversities in the structure of the adhesive digital pads, the eyes, the limbs, the digital characters and the degree of degeneration of the ear. Attention is also directed to the partial or total degeneration of limbs and to the probable significance of the, digital characters. Reference is made to the close affinity which certain Indo-Chinese and Malayan lizards have with forms that inhabit Southern India and it is pointed out that no satisfactory explanation has so far been given for this discontinuous distribution of the species. Skins of lizards are now extensively used for making leather and Dr. Smith gives very useful information on the subject under the section entitled 'Economics'. For non-techincal readers the hints under 'Preservation and Examination of Specimens' and 'Measurements' should prove very useful.

The systematic account of lizards contains a description of 297 species, 248 of which are from the Indian Empire. Much valuable information is included under each species and the workers on the group will always be indebted to the author for indicating, so far as possible, the type-localities and the present location of the types of the species treated. The work is full of notes based on personal observations and much biological information has been collected from other sources as well. The volume is fully illustrated. In short, for the present-day needs of taxonomic workers, museum curators and amateurs the work is most helpful and the author is to be congratulated on this production. The next volume on 'Snakes' will be awaited with considerable interest by Herpetologists in particular and naturalists in general.

S. L. H.

MISCELLANEOUS NOTES.

I.—A NOTE ON THE DISCOVERY OF *PIPISTRELLUS MORDAX* (PETERS) THE GRIZZLED BAT IN CEYLON.

Amongst a small collection of Pipistrelles sent down to me during 1933 by Mr. A. C. Tutein-Nolthenius from West Haputale, Ohiya, were two specimens of a bat that I had not previously seen in Ceylon. At first, I was inclined to believe that they were representatives of a new species, but as neither of them were good specimens I laid them aside until further specimens should be forthcoming. Later, as no others were then obtainable, I forwarded them to the South Kensington Museum, together with a few specimens of other species, for the opinion of Mr. M. A. C. Hinton.

In the meanwhile, however, on my return from leave in England, Mr. Tutein-Nolthenius forwarded to me a further complete specimen of the same species that he had caught in his bungalow. This, after careful study, confirmed by comparison with a specimen very kindly sent down to me by the authorities of the Bombay Natural History Society, I find to be an undoubted specimen of the Grizzled Bat, *Pipistrellus mordax* (Peters).

The type-locality of this species is given as Java, but the only existing Indian specimens have been obtained from Kumaon, Calcutta, Darjeeling and Kurseong (6,000 ft.) in the Eastern Himalayas, so it is of great interest to find that the species is also resident in Ceylon.

West Haputale, Ohiya, where it was found by Mr. Tutein-Nolthenius is in the highest part of the Central mountain cluster of Ceylon, the bungalow being at an altitude of 6,000 ft.

As only three specimens have been secured in spite of careful search, and as it has not been found previously, it would appear that the species is confined in Ceylon to the highest hills and that it is not at all plentiful.

The occurrence of Himalayan species in Ceylon is not unusual, a number of the mountain forms in Ceylon being very closely allied to, if not identical with, Himalayan forms; but it is curious that, in a number of instances, no similar or allied forms have yet been found in the Nilgiris. It is quite likely, however, that when the fauna of the higher South Indian mountains is better known, some of the species that at present have been recorded only from Ceylon and the Himalayas will be found in the intervening mountain tracts.

COLOMBO, CEYLON. W. A. A. PHILLIPS.

January 23, 1935.

II.—TIGERS IN THE SUNDERBANS.

I enclose the measurements of a Sunderbans tiger which I shot on the 28th December. I have heard that at one time you were anxious to collect data regarding the tigers of the Bengal Sunderbans, which seem to show very definite traits as a distinct race. It is a very different animal from the tiger of the Bengal duars (Terai).

As you know the Sunderbans tiger is a born man-eater and a source of endless trouble and inconvenience to us Forest Officers. Last year alone, there were 45 deaths of forest coolies attributed to tigers. We pay out high rewards to professional shikaries for the destruction of tigers, and since last March have received between 30 and 40 skins and skulls of tigers destroyed.

The skulls are usually destroyed, and are often sent in bad condition by the shikaries, but if you are interested, I can probably get some good skulls for you.

The tiger whose measurements I enclose was shot by me from my steam-launch at 4-30 p.m. on the 28th December 1934. At the time it was swimming across the Betmore Khal, a channel about ¼ of a mile wide. I shot the tiger through the head and killed it dead, and the body floated quite buoyantly. The tiger was a typical Sunderbans animal, an old male in good condition, short and stubby, with a heavy barrel-shaped body, and a coat of rather a pale tawny colour.

If the Sunderbans tiger are of any special interest to you, and if you think I can collect any specimens or data of value, I shall be glad to hear from you.

SUNDERBANS FOREST DIVISION,
KHULNA, BENGAL.
January 4, 1935.

T. V. DENT,
I.F.S.

[The measurements given by Mr. Dent of the tiger shot by him are as follows:—

Body Length (over curves)	9′
,, ,, (between pegs)	8′ 8″
Tail	2′ 10″
Height at shoulder	34½ ″
Girth behind shoulder	43½ ″

Mr. Pocock in his recent article on Tigers (*Journ., Bombay Nat. Hist. Soc.*, vol. xxxiii, p. 505) has shown how little is really known as regards variation among tigers in India due to age, season or locality. To arrive at any definite conclusions regarding such variation it is necessary to examine properly sexed skins and skulls obtained at different seasons from different parts of the country. The peculiar conditions under which tigers live in the Sunderbans may produce variation sufficient to differentiate them from tigers found in other parts of India. But without adequate data it is impossible to say whether such variation occurs, or if it does, to indicate its extent. We therefore gladly avail ourselves of Mr. Dent's offer to collect material from the Sunderbans and would welcome any notes that he can send us. We should also like to take this opportunity of once again drawing the attention of members to the need of obtaining skins and skulls of tigers from other parts of the country. We are aware that sportsmen do not usually part with such trophies but there may be many occasions when such contributions to our collections may be possible.—Eds.]

III.—TIGER KILLING SOLITARY BULL BISON (*BIBOS GAURUS*).

In the past six months three fine solitary bull bison have been killed by tiger on the Billigirirangans: all carried good and old heads.

Previous to this I have only known of four actual kills of solitary bulls (in twenty years) and of several unsuccessful attacks.

Honnametti Estate,
Attikan P.O., *via* Mysore.
January 3, 1935.

R. C. MORRIS,
F.Z.S., F.R.G.S.

IV.—TIGERS BURYING THEIR KILL.

As it has been questioned as to whether tigers sometimes bury their kill in Burma or not, I venture to record an interesting case that came to my notice in the Bhamo District.

A natural kill of a sambhur was reported to me, and I hurried off to see it. The sambhur had been killed, and dragged into a depression among long grass, but the villagers had taken the meat; and when I saw it nothing much remained. The man who showed me the kill then told me that the tiger had last night removed the few bones that had been left, and had buried them nearby. We went to see. About 20 yards out in the forest and under some teak trees I came across a considerable mound—perhaps three feet high, and of diameter about six feet across. It had been undoubtedly made by the tiger for his claws and pugs showed how he had scraped up the heap most clearly—just as if it had been raked up into a heap with a garden rake! It consisted of various debris to be found around, earth leaves, sticks, stones etc.—but what was most remarkable was that *a thick bough of a tree had been placed on top and right across it all*, as if to keep the whole down securely. There were no man tracks, or signs of man about, and I had little doubt that it was the tiger who had done this. The Burman with me assured me it was the work of the tiger. The bough was about eight feet long and about six inches in diameter—quite a weighty affair.

From under the heap came sufficient smell to leave no doubt about what was there. I did not disturb the mound.

That night I sat up in a teak tree over the mound. Rain began to fall slowly and it was very difficult to hear anything as the raindrops fell on the wide teak leaves. When it was quite dark I thought I detected a slight sound in the vicinity of the heap—then there was a sudden rush and the sound of the log of wood cast aside.

Nothing else happened. In the morning I examined the place carefully. The log had indeed been cast aside and was now lying about three feet away from the heap!

It must have been the tiger, but he had been scared by my presence and had plunged away. The fact that he had removed the log was sufficient proof to me that *he had himself placed it there* in the first instance. Tigers in Burma are excessively shy of anything in the shape of a trap, and had a man placed the log over the heap the tiger would most certainly not have dared to touch it.

Taunggyi, South Shan States,
Burma, T. R. LIVESEY.
March 29, 1935.

V.—HOW TIGERS KILL THEIR PREY.

In Burma all the buffalo I have seen killed by tigers had been hamstrung—the hocks, or one hock, crushed by a bite. I think this is invariably the way they kill buffalo, bison and tsaine in this country. In this way they do not risk an injury from the horns of the beast attacked. Burmans who have actually witnessed such attacks on their village buffaloes describe it as taking place in this manner, but they add that once the tiger has been able to roll the buffalo over by this crushing of the hock, he attacks, not the neck, but the belly. This is ripped up and causes death. I can quite believe this, as the neck of these large animals is too thick and massive for a tiger to bite into and reach a vital part, and besides there is the danger of injury from the horns and forefeet of the fallen prey. Neck bites are probably taken after death.

Do tigers and lions ever kill their game with a blow from their fore paw? I believe that they never do, and that they are quite incapable of delivering a powerful blow in this manner. It would seem to be against all reason, for they seek to grasp their game, not knock it away from them!

Kills never show such broken bones and bruises as would result from killing by blows.

It is constantly stated in popular articles that they do kill by a blow. Recently Major Forhan in the *Illustrated Weekly of India* stated in an article on the man-eaters of Tsavo that a man had been 'obviously killed by a blow' but gave no further details to substantiate this astonishing statement.

In the old days the Rajput princes used to sew up the mouths of tigers and cut off their claws, and then wrestle them with men. Sir Pertap Singh used to tell us so. If tigers could deliver a death blow the men would have been killed. The whole point of such contests was that man and tiger fought on equal terms.

Taunggyi, South Shan States,
Burma. T. R. LIVESEY.
March 29, 1935.

VI.—NOTE ON THE RECORD INDIAN LION (*PANTHERA LEO PERSICA* MEYER).

What is believed to be the record Indian lion was shot in the Gir Forest of Junagadh by Lord Belper on 8th March 1935. It was carefully measured between pegs and showed a length of 9 ft. 9½ in. The previous record, at least for the Gir Lion, is believed to have been 9 ft. 7 in.

JUNAGADH. P. R. CADELL.
April 9, 1935.

[The largest Indian lioness measured 9 ft. 5 in. (Rowland Ward 1928 Edition.)—EDS.]

VII.—ANTI-RABIC TREATMENT OF AN INDIAN LION (*PANTHERA LEO PERSICA* MEYER).

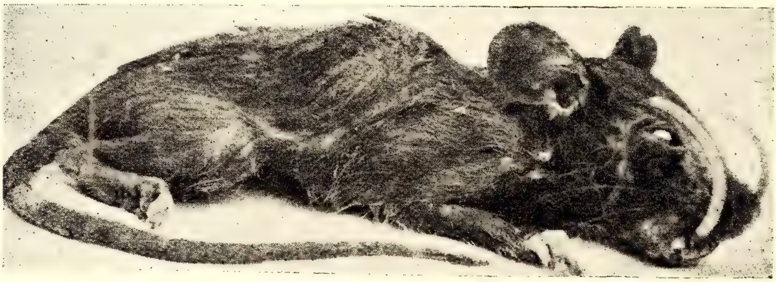
On 15th March 1935, a dog entered the Sakar Bagh in Junagadh, where a number of Gir lions are kept in captivity, and, after biting two local dogs, ran up to the bars of the open air compound of the cages in which the lions are kept. Sultan, a six year old lion, rushed to the bars to have a look at the dog which promptly bit upon the muzzle. Those who saw the incident agree that Sultan did not bite or strike at the dog, which however collapsed. A gun was procured and the dog was shot. It was almost certainly mad. When the matter was reported orders were issued for anti-rabic serum for animals to be obtained, but, as there seemed likely to be some delay in getting it, it was arranged for the lion to be inoculated with the serum kept in the local hospital for the treatment of human beings. An ingenious arrangement was prepared by Mr. E. A. Alton, Motor and Aeroplane Officer, whereby Sultan, having been induced to enter a small cage, was cooped at one end of it by a movable board. The serum was then injected by Mr. G. B. Fernandes, Veterinary Surgeon, in the loose skin below the belly. Sultan was allowed, after the injection, to return to his own cage. He did not appear to feel the prick of the injection, and entered the small cage daily without objection till the treatment was completed. The daily dose given was 10 cc. i.e., double the normal dose for a human being. No signs of rabies have appeared.

JUNAGADH. P. R. CADELL.
April 9, 1935.

VIII.—ABNORMAL DENTAL GROWTH IN A RAT.

(*With a photo*).

At Paungde (Burma), in the course of energetic trapping during the plague season of 1932, a rat attracted special attention by the size of its teeth which prevented its entry into the trap. A photograph of this rat was exhibited at a meeting of the Zoological Society of London on May 17th, 1932. The comparative rarity of the condition and the special features associated with it, together with the fact that neither the photo nor description has yet been published, render desirable a record of this case of abnormal incisor growth. The rat was identified as *Rattus norwegicus* (Erxleben 1777).



Abnormal teeth in a rat.

The length of the body was 4.5 in., that of the tail 3.75, and that of the hind-foot 1.25. The inferior lateral incisors have grown in a more or less, semi-oval shape successively turn upward, backward, and slightly outward. In their first quarter, they enclose and come in apposition with the lateral aspects of the front part of the upper jaw including the nose, and lie free in the rest of their course. When viewed from the front the upper jaw appears to be wedged in between the lower parts of the pair of 'tusks'. Each individual tusk is approximately 3.5 cm. in length and 2 mm. in diameter at its base: in cross-section the base is circular but, as the tusk tapers to a point, it becomes flattened. The pair of central incisors is also abnormal, each being approximately 1 cm. long. In addition a stump of an old broken tusk can be seen.

As a result of these abnormal dental growths the facial appearance of the animal is considerably altered. The upper jaw is separated from the lower by a gap of 8 mm., the mouth being closed by the dental bars like a prison gate.

The abnormal growth of rodent incisors is reputed to be of common occurrence, but rarely do we find such abnormal features as the present example. What causes this abnormal growth? Cases of abnormal growth of human incisors are known. The factors which produce these may also be responsible for the formation of abnormal rodent ones, though to a greater extent. Close apposition of two sets of teeth keeps their size within normal limits: loss of that apposition, for any reason, reduces or prevents wear. Further, the mechanical features associated with mandibular movements cause the dental outgrowths to take the direction of greatest mechanical advantage. Whether the abnormal dental direction, resulting in abnormal dental growths, is the outcome of a congenital malformation, or of an acquired traumatic or other pathological condition, cannot be definitely stated. The lack of any evidence of trauma or disease favours the probability of the condition being congenital. Whatever the original causative factors, that the resulting condition must have profoundly affected the dietetic habits of the animal is obvious, the animal not only being deprived of the important cutting function of the teeth, but also having to encounter great mechanical inconvenience in biting and mastication: this is the explanation of its emaciated appearance.

PAUNGDE, BURMA. R. L. SONI,
February 23, 1935. M.B., B.S.

[The specimen has since been submitted to Sir Frank Collyer, Royal College of Surgeons, London, whose report is awaited.—EDS.]

IX.—BIRTH OF AN ELEPHANT CALF (*ELEPHAS MAXIMUS* LINN.).

During a shooting trip at the end of last year, at Christmas, my friend Mr. N. H. Dendy of Tillicoultry Estate, Lindula, came across something so unusual and interesting that I think it should be recorded in the *Journal*.

Mr. Dendy was camped near the Menik Ganga, the river, one of the natural boundaries of the Yala Wild Life Sanctuary, soon to be declared the first Strict Natural Reserve in Southern Province, Ceylon. One morning quite early Mr. Dendy and his men walking along the high river bank, disturbed and watched a cow elephant and her calf.

After about half an hour the mother and calf moved away slowly into the dense forest along the river. The men remarked that the calf could not possibly be much older than a day or two. They had never seen so small a calf.

Going further, something red on the sands drew their attention and going down to look, they found the perfectly fresh placenta of the elephant. Knowing the elephant's habits, this must be a most rare experience and it would be of interest to know if this has ever been recorded before. It was early in the morning so the sun was not high enough up yet to shine and dry it. A certain proof the elephant had calved that night or even, and I think more likely, only a few hours before the party reached the place. It is known that an elephant calf is able to get up and follow the mother about two hours after birth, while various authorities state that the elephant eats the placenta.

At any rate it must be extremely rare to find it, as the sun would soon dry it up, if jackals, crocodile, etc. had not made away with it. The very exceptional drought this poor country has suffered from so severely, no doubt made the elephant choose this unusual place for the calving, knowing that the pools left in the river, were the only water she could get within miles. As a rule the elephant mother chooses the most dense cover she can find, which is all the more reason few, if any, have ever come across so remarkable a find in the jungles and wilds.

In the sand, Mr. Dendy and his men could see clearly the place she had laid down to give birth.

Mr. Dendy estimates the total weight of the placenta at about 5 to 6 lbs. The far side, darkly coloured, consisted more or less of solid flesh, the lighter coloured and a small patch on the right, was like frothy blood. Much to the surprise of Mr. Dendy, after some hesitation, the excited men asked if they might take it, they explained that when washed and dried, the solid part would make a very valuable and excellent medicine. It is said that a small bit of the dried substance, dissolved in a little lime juice and water, will at once relieve a woman's labour pains, or will help to advance an overdue confinement.

All folklore is of great interest, but considering the so great rareness of ever finding the placenta of a wild elephant, this bit of jungle lore is all the more unique.

Both men, as well as others who have spent their lifetime as watchers in the sanctuary and the neighbouring reserve, had never seen the placenta and knew of no one who ever had. The two men with Mr. Dendy had never come across the calving place of an elephant, a very rare thing to find. And yet, handed down for generations, they one and all knew the story of this most valuable medicine.

It was not quite clear from the impressions in the sand, to be quite certain about the position the cow elephant had occupied, but in all probability she must have been lying on her right side, her back turned towards the place where the men are standing.

In this connection it is of interest to remember the photograph of a cow elephant which died in calving, published in 'Kill, or be killed', by Major W. Robert Foran. This photo clearly shows the animal lying in the kneeling position. I have not been able to find any authority who describes the true position the elephant calves.

It would be of interest to know if any one has ever come across so rare and unusual a find as described above.

WEST HAPUTALE,
OHIYA, CEYLON.
April 9, 1935.

A. C. TUTEIN-NOLTHENIUS.

[G. H. Evans in his work on *Elephants and Their Diseases* describes the birth of an elephant calf on information obtained from an experienced Burman—'When about to give birth the female seeks soft ground. The calf may be presented head and fore feet or the hinder parts may appear first. If the membranes are not ruptured by an attendant, the female does so with her foot. The young one lies from one to two hours after birth, occasionally moving ears, trunk, limbs, after which it gets on its legs and can walk. Elephants even in the wild state may die in labour—the author records an instance. A newly born calf can walk well enough after a few days to follow the mother on a short march, and in the wild state, when a calf has been dropped, the herd remains in the vicinity until it is able to follow the mother; which is generally in about 48 hours. The author is of opinion that the 'after birth' is usually eaten. It comes away 15 or 20 minutes after the birth of the calf.—EDS.]

X.—GROWTH AND SHEDDING OF ANTLERS OF SAMBUR AND SWAMP DEER IN ASSAM.

In No. 3 of vol. xxxvii, I saw a note about 'Growth and Shedding of Antlers in the Swamp Deer (*Rucervus duvaucelli*) in Manipur State'.

I saw Swamp Deer in Assam, along the border of Bhootan and along the foot of the hills, in spring, 1892 and also some of the poorly horned Sambur of that area.

On the 8th of March, I shot a sambur with horns fairly worn out by rubbing against the grass. The same day, I saw another one with horns hardly half grown and, of course, in velvet.

On March 14th, at a place ralled Raimana, a large Swamp Deer had horns half grown, in velvet, with the brow tine fully developed and the fork above showing the beginning of the other tines.

On March 18th, another Swamp Deer appeared to me to have tines almost fully grown except the top ones.

On March 21st, I shot a fine Swamp Deer, at a place called Kochugaon. His horns were still in velvet but fully grown, just the tips of the top tines were still a bit soft and rounded. By a strange piece of luck, from the back of my elephant, I saw a shed horn in perfect condition on the ground which the elephant picked up for me. It was only a few hundred yards from the place where I had shot the stag and, to all appearances, must have been one of the very same stag. I kept it, and was sorry that it was not on the stag at our meeting.

I consider that the beginning of the rains is probably the time when the Swamp Deer in Assam are in their prime. This would show a difference of season to that of Manipur, but this may vary from one place to another according to the locality.

Montevran, Chaumont-sur-Tharonne,
Loir-et-Cher, France. VISCOUNT ED. DE PONCINS.
January 10, 1935.

XI.—SOME LITTLE-KNOWN BIRDS OF NORTHERN BURMA.

I have already recorded in the *Ibis* of January 1935 the occurrence of the birds mentioned below in the Myitkyina District of Upper Burma. As the records are so few and far between, the following additional notes made in the District in 1934-35 are possibly worth recording.

Psittiparus g. gularis. Grey-headed Parrot-bill.

The only published Burma record is of one obtained by Capt. W. M. F. Gamble at Tutuga (Myitkyina District) in January 1933. A male was brought to me by an Atzi at Sadon on December 21st 1934, obtained at about 3,500 ft. with a pellet bow, in bamboo (iris red brown, bill orange-yellow, legs slaty-green).

Ciconia nigra. Black Stork.

This is probably an annual visitor to the upper reaches of the Irrawaddy, as I saw two large gatherings on sandbanks in November 1934, one being in exactly the same place as I observed them in November 1933.

Ardea imperialis. Great White-bellied Heron.

I again found this bird by no means uncommon between Sinbo and Myitkyina in November 1934. Individuals were seen at various places along the river and were not at all shy, feeding close to villages, and allowing a launch to approach quite near to them, before they took to flight.

Podiceps c. cristatus. Great Crested Grebe.

There are two previous recorded occurrences of this Grebe from the District but very few Burma records otherwise. On November 20th, 1934, I saw one on the river a few miles south of Myitkyina, and shot one of a pair on the Hokat jheel still further south. On November 21st I saw one swimming with a party of cormorants near Sinbo.

MYITKYINA,
UPPER BURMA.
December 21, 1934.

J. K. STANFORD,
Indian Civil Service.

XII.—MATING HABITS OF MYNAHS AND CROWS.

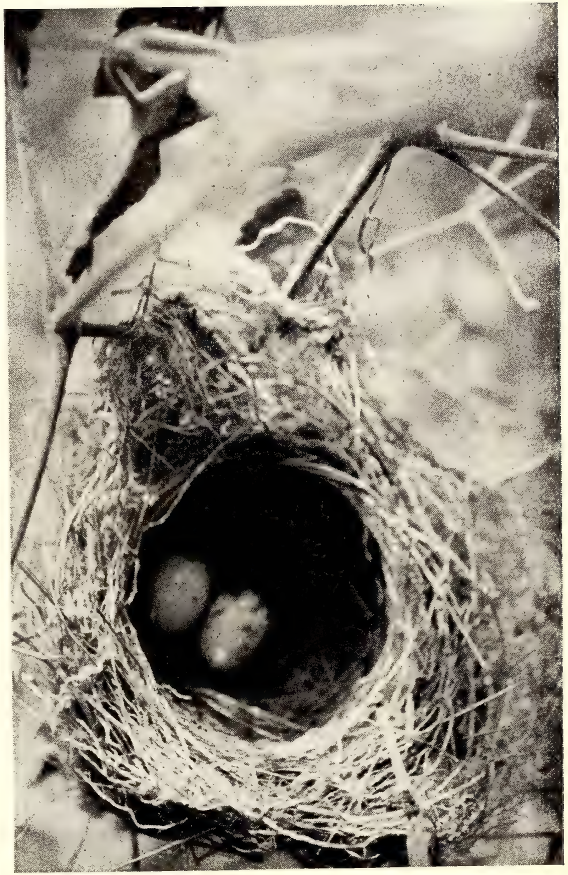
Between January and March, I had occasion to observe the pairing habits of certain birds. My attention was attracted by the extraordinary noise made by some Common Mynahs (*Acridotheres tristis*). To me, it seemed, that a pair of them were in a deadly combat. I watched them from a distance. A third one suddenly appeared on the scene but it remained an indifferent spectator. The interesting aspect of the combat was, that though the participants could have separated and taken to wing they continued the struggle. Each fiercely pecked at the other's beak, legs, wings or body. Finally the combat ended. The birds lay by each other with their vents apposed. This continued for about 15 seconds, then they parted and flew off.

It was then, I concluded that the strenuous combat may have been only a method of courtship or 'love play' and the apparent rest they took was actual copulation.

I was able to watch the behaviour of some mynahs two days later when two pairs were through a similar performance. They began their 'fight' on the branches and the house-tops and finally fell to the ground in the course of the combat. What I presume was that copulation took place during the 10-15 seconds of quiescence which followed. The whole performance was repeated at short intervals.

It is interesting to compare this habit of mynahs with the normal pairing habits of birds. The same method is apparently adopted by crows. Coitus is presumably effected side by side with

Ramsay's Bar-wing (*Actinodura ramsayi*). The Bird in the nest.



Nest and eggs of Ramsay's Bar-wing (*Actinodura ramsayi*).

the vents apposed, which, if my conclusion is correct is in contrast to the normal position of other birds such as sparrows, kites, etc.

It is interesting to note that the observations suggest two different ways of pairing in birds.

MEDICAL COLLEGE,
VIZAGAPATAM.
February 18, 1935.

K. I. VARGHESE, M.A.

[There is a general belief that crows copulate in the manner suggested by the writer of the note; colour is lent to this belief by the frequent combats which take place between crows during the period which immediately precedes their breeding season and also by the fact that copulation is rarely observed. However, on the rare occasions when it has been observed, the act was performed in the manner normal with birds. Mr. Salim Ali has made such observations and has seen crows pairing usually early in the morning. We do not therefore consider that we have any real evidence in support of the popular belief that there is a deviation from the normal in the mating habits of crows, nor do we consider that the writer of the above note is justified in his conclusion that the combats between mynahs are a preliminary to mating or that coitus takes place during the brief period of quiescence which follows a combat. Unless some pairs are actually shot in the act of scuffling and sexed and the passage of the male sperm ascertained by microscopic examination one could not accept the evidence offered by Mr. Varghese as conclusive. It is more than likely that the scuffles which take place among these birds are between rival pairs, both males and females sometimes join in the mêlée. Mr. Salim A. Ali in a recent letter to the Society mentions that he has seen several pairs of mynahs mating in the ordinary manner and that he hopes to collect further evidence on this point. We hope that Mr. Varghese will continue his observations regarding the mating habits of these common birds.—EDS.]

XIII.—NIDIFICATION OF THE SHAN STATES BAR-WING [*ACTINODURA RAMSAYI RAMSAYI* (WALDEN).].

(*With a plate*).

As the nidification of this bird remains still undescribed, I send you a note and photographs of a nest found by me two years ago.

It was on April 11, 1933, that I found the first nest of this Bar-wing, in the Southern Shan States, up in the hills at Sintaung, some twelve miles south of Taunggyi. The elevation above sea-level would be about 5,500 ft. That locality is particularly beautiful, wild rocky peaks rising to nearly 7,000 ft., with open down lands and ravines, patches of thick forest and green glades between. The local hill tribe are the Taung-yos, and they know a great deal about their birds. To them this Bar-wing is known as 'Nget pi pi'—presumably from its loud call note.

I was resting by a cave and waterfall, by the side of a rocky, scrub-covered hill, when I noticed a Bar-wing with building material in its bill fly up into a lot of creepers overhanging some rocks. But on searching the creeper carefully I could not see any signs of the building nest. The creeper was not a dense one, but somewhat dried-up, and yellow, with a good deal of feathery, 'silk' on it. I returned in five days' time, and to my delight, the birds were there. The nest I could now make out built very slenderly out on the edge of the creeper amongst the 'silk'. As the bird was still sitting on her nest when I got to within three yards of her, I was able to take a photograph of her sitting on the nest. Her tail is seen sticking out over the edge of the nest—long and straight.

There were two eggs—typical Bar-wings—but handsomer ones than those I had previously seen in the Chin Hills.

The nest, suspended in the half-dried-up creeper, hung out some ten feet from the ground over the rocks—a part of the same creeper ascending a thickly foliaged tree near by. It was made of yellowish round roots and was lined with finer ones of the same character. The outer part of the nest had some of the creeper's feathery yellowish-white 'silk' worked into it, so that the nest was by no means easy to distinguish. Had I not known the exact spot I would surely have overlooked it.

The eggs measured approximately 23 mm. by 17.4 mm. They were of a delicate blue-green—the colour we associate with eggs of the English song thrush—but rather paler, and still more beautiful as the shells were of a delicate texture and being so thin gave the eggs a lovely transparency. The markings were few but bold in character—a few blotches and scrolls of purplish chocolate—some of the scrolls being drawn out into hair-lines. There were a few underlying blotches of lilac colour. The markings were mostly situated at the larger end of the eggs almost forming a zone.

Subsequently I saw many more of these Bar-wings' eggs, and they were all of the same type—but there are occasionally some that are weakly coloured, and such eggs approximate somewhat in appearance to a certain type of egg rarely laid by *Leioptila melanoleuca radcliffei*.

It has been said that the Bar-wings are very similar to the Sibias. Morphologically that may be so, but their appearance and habits are different, the Bar-wings being secretive birds, somewhat heavy in flight, and keeping to the lower growth, while the Sibias are elegant and conspicuous birds. But both have sweet and loud musical call notes—tender, pleading and somewhat mournful.

The call note—or is it the song-note?—of this Bar-wing is loud and plaintive and can be heard at a great distance. It consists of six notes falling in cadence—'Pi-pi pi-pi pi-yuuu' the last note being mournful, plaintive and prolonged. There is about two seconds' interval between each double note, and about one second's interval between each 'pi-pi'.

Recently I heard a bird calling in the thick, green jungles 60 miles north of Myitkyina which I took to be a Bar-wing. The call was of the same character but consisted of 'Pi-yuu—pi-yuu—pi-yuu'—the intervals being somewhat longer—say four seconds, between each double note.

In future bird books let us hope some attempt will be made to describe with something approaching accuracy the colouration of birds' plumage and their eggs; and also their notes. The former should be described in terms of recognised artists' colours—which are the colours nearest to nature's—and a colour chart, as a guide, published on the front page. Birds do not wear chemically-coloured ladies' dresses! And as to the songs and notes of birds, a proper system is much to be desired. It should not neglect to give the approximate intervals between notes as such are very characteristic of the different species of birds.

TAUNGGYI, SOUTH SHAN STATES,
BURMA.
March 17, 1935.

T. R. LIVESEY.

XIV.—NIDIFICATION OF THE BLACK-HEADED BABBLER [*RHOPOCICHLA A. ATRICEPS* (OATES)].

With reference to Capt. Bates' letter on the nidification of the Black-headed Babbler (*Rhopocichla a. atriceps*), I am pretty sure that Davidson was right in stating that this bird builds 'cock' nests which are never intended for breeding purposes. Wherever the species occurs one finds dozens of these nests in the jungles at all times of the year. They are very loosely and untidily constructed, usually in full view and I have never seen one with any lining. Dead bamboo leaves are the favourite material and I found one beautiful specimen made entirely of skeleton leaves. Though I have disturbed birds roosting in this type of nest, all those which I have found containing eggs or young have been much smaller and more neatly and firmly woven. Unlike the 'cock' nests they are usually very well hidden and have a lining of black rootlets or grass. While, as Bates says, one may find half a dozen of the former type in as many yards of thicket, the breeding nests are usually quite isolated. The Ceylonese sub-species *nigrifrons* has precisely the same habits.

COOVERCOLLY,
SOMWARPET, COORG.
December 31, 1934.

F. N. BETTS.

XV.—ON THE OCCURRENCE OF THE TIBETAN SISKIN [*SPINUS THIBETANUS* (HUME)] IN NORTHERN BURMA.

In the *Ibis*[1] for April 1935 I recorded the occurrence of this rare finch in March 1933 near Sadon in the Myitkyina District at about 3,000 ft. Prior to this, it had only been known in India from the Tibet-Sikkim border, and in Burma from three obtained by Lord Cranbrook at 6,600 ft. in the Adung Valley (in the far north of the Myitkyina District) in March 1931. On December 20, 1934, I obtained four out of a flock of about 20 birds in the valley of the N'Gri Ḫka about 6 miles west of Sadon, at a height of about 2,000 ft., one of which I was unable to preserve. They were all singing together with a typical Siskin note, in a tree after bathing in the stream. Two of those obtained, sexed as females, were heavily striped on the upper parts. (Iris, brown; bill, bone-grey; legs and feet, vivid brown.)

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[1] *Ibis*, 13th Ser. Vol. V, p.265.

Myitkyina,
Upper Burma.
December 21, 1934.

J. K. STANFORD,
Indian Civil Service.

XVI.—VULTURES FEEDING AT NIGHT.

On December 15, 1934, while Mr. and Mrs. P. Learoyd of Ootacamund were sitting up over a tiger kill at the foot of the Billigirirangans, vultures descended from the surroundig trees at about 8 p.m. and by 11 p.m. had completely demolished the remains of the kill. Although it was moonlight, I cannot recall a similar case having occurred before.

Honnametti Estate,
Attikan P.O., *via* Mysore.
January 3, 1935.

R. C. MORRIS,
F.Z.S., F.R.G.S.

XVII.—PEREGRINE AND SPUR-WINGED PLOVER.

The delightful note by Mr. Stanford describing the drill-dance and manifestation of the Spur-winged Plover prompts me to tell of a most curious incident I witnessed in Burma a few years ago in which the Spur-winged Plover—the Japanese Print Bird—played an astonishing rôle.

I was slowly ascending the lovely Salween River in Karenni in a small boat, when my attention was attracted by a Spur-winged Plover in a very frenzy of agitation. He had come to the very end of a sand-spit just in front of my boat, and as I came to within about twenty yards of him, *he actually took to the water like a duck and swam out into the river.* He rode the water easily and lightly—with grace. I was dumbfounded at this exhibition! He then suddenly ducked *and dived clean under*! At the same moment there was a tearing sound and a fine Peregrine came at his stoop and skimmed over the ripples where the Plover had disappeared!

After about three or four seconds up bobbed the Plover again on the surface tittering with fear, while the Peregrine looking over his shoulder swung up and round to repeat his stoop. Then he came again at the Plover and as before just when he was within a few yards the wily Plover again dived! By this time my boat was nearly on top of the Plover who bobbed up, and then began to swim ashore. The Peregrine had flown off baffled completely by these tactics. The Plover landed safely and ran along the shore, still very rattled by his narrow escape from death.

And so I left him there bobbing up and down and shaking the wet off his plumage on a sandy-spit by the Salween.

TAUNGGYI, SOUTH SHAN STATES,
BURMA.
March 29, 1935.

T. R. LIVESEY.

XVIII.—DISTRIBUTION OF THE INDIAN HOOPOE (*UPUPA EPOPS ORIENTALIS* STUART BAKER).

On page 308 of vol. iv of the *Fauna of British India* (2nd edition), as an instance of the wandering habits of Hoopoes, *Upupa epops orientalis* is quoted as breeding as high as Sukna in Darjeeling, some 7,000 ft. elevation.

As a resident of the Darjeeling District for many years, I write to say that Sukna is at the foot of the hills at 1,000 ft. elevation and is on the actual natural dividing line between hills and plains with sal forest on the north side and tea and rice fields on the south.

In fifteen years I have never seen any other Hoopoe but *U. e. saturata* in these Hills, which passes through in late August or early September returning in March and April, some birds dallying quite a while by the wayside. The earliest recorded downward date is August 17th and the latest upward date is May 17th when two birds hung about the tea garden for 3 weeks and then suddenly disappeared.

Round Siliguri, some 7 or 8 miles from the foot of the hills I have seen both *U. e. saturata* and *U. e. orientalis* together, in December, the latter being resident.

The reference to Sukna and Darjeeling on page 311 is ambiguous but the reference on page 308 shows that Sukna is assumed to be the same elevation as Darjeeling, thereby greatly enhancing the difficulty of dividing up the sub-species.

NAMRING T.E.,
RUNGLI RUNGLIOT P.O.,
N. BENGAL.
March 8, 1935.

W. H. MATTHEWS.

XIX.—THE LESSER FLORICAN [*SYPHEOTIDES INDICA* (MILLER)] IN THE KONKAN.

A female Lesser Florican was shot by Mr. J. Stokoe near Karjat at the foot of the Bhor Ghat on Sunday the 20th January 1935. As the Florican rarely enters the area lying between the Western Ghats and the sea, the record is of interest.

BOMBAY NAT. HIST. SOC.,
6, APOLLO STREET.
February 2, 1935.

S. H. PRATER,
C.M.Z.S.

XX.—SOME NOTES ON WOODCOCK (*SCOLOPAX R. RUSTICOLA* LINN.) IN BURMA.

The *Fauna* (2nd edition) states that in India the Woodcock is 'merely a casual migrant to the plains, the great majority of the Himalayan birds being resident or merely moving to lower levels in the winter'. Its breeding haunts are stated to be the Himalayas from 8,000-12,000 ft. and the 'mountains of Northern China'.

Mr. E. B. Bloech (*Journal*, vol. xxxiii, p. 715) has shown that the Woodcock is a regular winter visitor to the western edge of the Pegu Yoma in Lower Burma. It certainly occurs regularly in winter at about 3,000 ft. near Maymyo in the Shan States, which is only 26 miles away from one of the driest parts of the dry zone. Mr. E. W. Allan, of the Indian Forest Service, found it common at about 3,000 ft. in the Kyangin township of Henzada District in the Henzada-Arakan Yoma. Capt. E. H. Cooke shot a migrant in the Fort at Mandalay, and I have recorded its occurrence in 1929 in the plains of Prome District. I also once saw a Woodcock, almost certainly a passing migrant, which had been disturbed out of a neighbouring garden, fly over the tennis-court of the Monywa Club on the Chindwin in October or November 1924. Col. R. M. Jacob tells me it is to be found regularly in various parts of the Chin Hills in winter, from 5,000 ft. upwards. These occurrences suggest that it is not a casual, but a regular, winter migrant over a very large part of Burma, to be found from late October to March whenever conditions are suitable. In the Myitkyina District of Northern Burma it certainly occurs, as a winter visitor, in some numbers over an area of 15,000-20,000 miles both in the plains and in the hills. On October 23, 1934, one flew over the Myitkyina Club at dusk, and I saw another flighting at dusk out of my garden in the same week. These were probably birds on migration. Capt. D. M. Fife tells me they occur at Laukhaung (3,000 ft.) in the N'Mai and Ngawchang Valleys and round the Panwa Pass on the Yunnan border (6,000 ft.) from December to mid-February. In January 1935, Messrs. A. S. Vernay, R. C. Morris and myself found a number flighting in every evening to wet ditches and paddy stubble on the edge of evergreen forest near Lonhkin in the Jade Mines. I saw at least three of these birds come high over the trees in the dusk, set their wings and stoop like a snipe or a falcon down to their feeding-grounds, though once they had started to feed they more or less fluttered up and gave very easy shots. In some of these ditches, the marks of their beaks and feet could be seen by day, and indicated where to wait for them. On January 1, 1935, I shot two feeding by day, on the Talawgyi plain, one in dew-covered short grass like wild barley; which at the time was full of feeding snipe, and the other on the edge of a jheel where it was feeding with Fantail and Painted Snipe about 9 a.m. In late February 1935, while we were beating for jungle fowl in scrub jungle opposite Myitkyina, as many as eight were flushed and six shot within a radius of about 300 yds. These birds were lying in dry scrub and bamboo jungle, and their feeding ground was probably the mud of a backwater of the Irrawaddy 200 yds. away. In early March, Capt. J. G. Hurrell saw as many as six in one jungle-fowl beat near Myitkyina. I have seen these birds flushed out of quite dry grass jungle by day, but one of their favourite haunts seems scrub or cane-brake jungle where shallow streams run out into the fields. Capt. Lyle tells me he has shot them at Sima (4,000 ft.) flighting to places where springs come out of the hillside. They rarely fly far in a beat and when first flushed, if not shot at, usually pitch again within 100 yds. It is to be hoped that before long the Woodcock will be found breeding in the hills of the North-East Frontier of Burma, on the Tibet or Yunnan border. There must be some breeding area in between the Himalayas and the North China hills which is yet to be discovered.

MYITKYINA. J. K. STANFORD,
April 14, 1935. *Indian Civil Service.*

XXI.—ALBINO FAN-TAIL SNIPE (*CAPELLA G. GALLINAGO* LINN.).

I am sending you under separate cover a white snipe I shot about 20 miles from Bangalore on the 20th instant. I don't know how common such a specimen is but thought it might interest you.

I was shooting the border of a shallow tank where the snipe were fairly plentiful but wild. A couple got up together at extreme range and I fired the left barrel at the leading snipe but missed. I then noticed that the second one appeared completely white. I marked it down about 400 yds. further on and eventually shot it sitting as I didn't want it to escape again! It was very conspicuous, being visible from well over 100 yds. away where an ordinary snipe would have been unnoticed at 20. I apologise for the very bad skinning but I had to do it late at night.

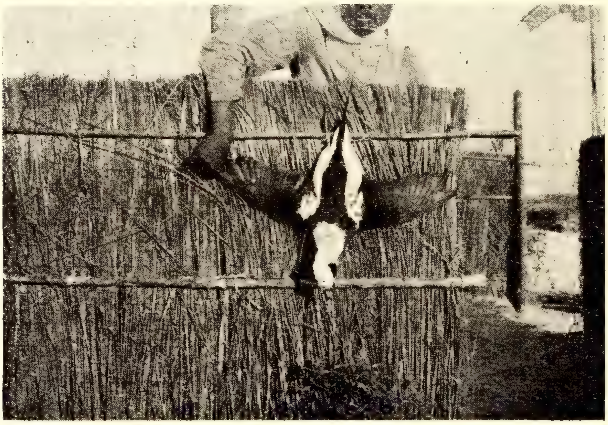
Lt.-Col. J. V. J. Ellis, R.A., who has since gone home, told me about last November that he had seen a white snipe while shooting from Bangalore, but had failed to get a shot at it.

R. A. MESS, H. C. M. DUNN,
BANGALORE. *Lt.*, R.A.
January 23, 1935.

XXII.—A SECOND RECORD OF THE OCCURRENCE OF THE LONG-TAILED DUCK (*CLANGULA HYEMALIS* LINN.) IN INDIA.
IN INDIA.

(*With a photo*).

I enclose herewith two photographs of a specimen of a drake Long-tailed Duck, *Clangula hyemalis*, which I shot on a wide sweep of the River Brahmaputra at Messaki, at the western end of the Pasighat Sub-Division of the Sadiya Frontier Tract, on Wednesday the 23rd of January, 1935. I tried to skin the bird, but knowing very little of the business and how to preserve the skin, it went bad in the end. I kept one of the long tail 'pins' however which I also enclose herewith. The other 'pin' was somewhat shorter. I do not think there is any possibility of a mistake in identification for the black and white plumage with the black chest and white abdomen, the long 'pins' in the tail and the pink and black bill (a typical duck's bill) were to my mind unmistakable. The bird when first seen was swimming in the water quite close to the boat in which my wife and I were; but it seemed unable to fly. It gave a fine exhibition of diving before it was shot. I killed it thinking it was an injured smew. Later I discovered the apparent reason for its inability to fly, for it was gorged right up to the mouth with small freshwater shrimps. There were two other flocks of duck on the same water of which the males looked black and white and were apparently; the females looked dark brown, through a pair of field glasses. I was unable to get a shot at them for they were very wild. I cannot say therefore for certain if they were the same species as the one I shot, although the black and white birds in the flocks looked the same from the distance. These two flocks were on the same water on 16th February 1935 when I returned to Messaki on the homeward journey of my tour, but although I tried hard to secure another bird, I failed, for they were as wild as ever.



The Long-tailed Duck (*Clangula hyemalis*)

I cannot account for the bird I shot for its presence where I shot it seems very extraordinary indeed. It was very fat and seemed very heavy for its size. It was in splendid condition. Doubt will probably be cast on the record since I see that the duck has only been recorded once before in India and that from Baluchistan, but I think the accompanying photographs will set it at rest.

Pasighat, N.-E. Frontier,
Assam, India.
April 1, 1935.

R. E. PARSONS,
Assistant Political Officer.

XXIII.—THE OCCURRENCE OF THE SCAUP (*NYROCA M. MARILA* LINN.) IN THE BHAVNAGAR STATE.

Many thanks for your kind information about the duck I sent to you, and which was indentified as the Scaup (*Nyroca m. marila*).

I shot this duck in the last shoot of the season on the 22nd February last, at a place called Hathab, about 17 miles from Bhavnagar along the sea coast. The tank is about a mile from the village and consists purely of rain water. It is very badly situated for a shoot as the sea is about 150 yds. away, only a range of sand dunes dividing the tank from the sea. It has a small patch of reeds, but not thick enough to give any cover. All the ducks after being shot at for a very short time, make straight for the sea and very poor shooting is to be had. For this reason I arranged to have two Peregrine Falcons to 'wait on', so as to keep the ducks in the tank. As a result we shot 35 ducks out of about 100, with 3 guns. I think this is a very good bag considering the bad situation of the tank.

There were many other varieties of ducks, mostly Tufted Pochard (*Nyroca fuligula*) and Gadwall (*Chaulelasmus streperus*).

Another rare duck was shot by one of my friends. This small duck was flying very much slower than the others; its greyish-white colouring made it quite distinctive. It was eventually wounded and secured. I identified it as a female Marbled Teal (*Marmaronetta angustirostris*). It is still alive at our duck house. This species is a rare visitor here only. One male specimen was shot in 1931 at a village called Tarsamya just two miles from Bhavnagar.

NILAMBAG PALACE,
BHAVNAGAR. K. S. DHARMA KUMARSINHJI.
March 10, 1935.

XXIV.—THE BRONZE-CAPPED TEAL [*EUNETTA FULCATA* (GEORGI)] IN THE SAMASTIPUR DISTRICT, BENGAL.

I have sent under registered post today the head of a duck for identification as no one on the shoot could identify the same, some of the Mallahs having been out shooting in this jheel with Planters for more than 50 years. Most unfortunately the young Mallah who picked it up 'hilal-karoed' it, before it was seen by us.

One of my old orderlies called it a Bengal Duck. Mr. E. Abbott of Hathwa who was shooting, has shot on this jheel for over 50 years and has never seen any bird like it.

On this same jheel, a Baikal Teal was shot about 4 years ago.

HURSINGPORE, SAMASTIPUR P.O.,
B. N. W. RY. C. I. PARR.
February 4, 1935.

[The head sent by Mr. Parr was that of a Bronze-capped teal. —EDS.]

XXV.—OCCURRENCE OF THE MARBLED DUCK [*MARMARONETTA ANGUSTIROSTRIS* (MÉNÉTRIÈS)] NEAR POONA.

On the 15th December 1934, I was duck shooting at Ravengaon Lake 54 miles south-east of Poona, the duck were very plentiful, more so than in the last four years that I have spent in this district. Amongst the duck I shot was a solitary bird which you have since identified as a Marbled Teal (*Marmaronetta angustirostris*). This is the only occasion that I have seen this duck in these parts though I have seen several shot at Khush Dil Khan near Quetta. I was interested to hear that this bird has not been recorded further south than Baroda.

7, Lothian Road,
Poona.
January 31, 1935.

F. C. HICKIE,
Lt.-Col.

[The Marbled Duck is a common cold weather visitant to Sind and is less abundant in the provinces which adjoin it. From this area it occurs as a straggler in other parts of India. In the Bombay Presidency it has been recorded from Gujerat and Kathiawar, but not, as far as we are aware, so far south as Poona.—Eds.]

XXVI.—THE SHELDRAKE [*SARKIDIORNIS MELANOTUS* (PENN.)] AND THE COMB DUCK [*TADORNA TADORNA* (LINN.)] IN SIND.

The Sheldrake or Dunn Duck. One was shot at Bhujo (Jungshai District, Sind) by Major Osborne, Royal Sussex Regiment on the 11th December 1934 (very far south for this duck). One was shot at Badin, Hyderabad District, Sind, between the 24th and 30th December last year by a party consisting of officers of the Royal Sussex.

The Nukta or Comb Duck. One was shot at Mirpur Bothoro, Sind, between the 17th and 20th November 1933 by Major Osborne, Royal Sussex Regiment.

Karachi.
January 21, 1935.

C. B. RUBIE,
Lt.-Col.

[The Sheldrake is a rare visitor to Sind. It has been secured on the Manchar Lake and at Jhunpur on the Khinjar Jheel.—Eds.]

[The Nukta has been previously recorded from the Kati Dhand, Sujawal District (Webb, *J.B.N.H.S.*, vol. xxi, p. 685) and has been obtained at Badin.—Eds.]

XXVII.—ARRIVAL DATES OF MIGRANT BIRDS IN COORG.

I subpend a list of arrival dates of migrants this cold weather in case they may be of interest.

September	3.	Marsh Harrier.
September	5.	Grey Wagtail.
September	9.	Pintail Snipe.
September	21.	Common Indian Bee-eater (Local migrant).
September	17.	Eastern Swallow.
September	29.	Brown Shrike.
October	5.	Great Reed Warbler.
October	5.	Red Breasted Flycatcher.
October	8.	Black Drongo (Local migrant).
October	10.	Indian Oriole (Local migrant).
October	16.	Indian Pitta (Local migrant).
October	17.	Black-headed Cuckoo Shrike (Local migrant).
October	17.	Blue-headed Rock Thrush.
October	18.	Indian Blue Chat.
October	19.	Forest Wagtail.
October	26.	White Wagtail.
November	3.	Indian Tree Pipit.
October	26.	Verditer Flycatcher.
November	23.	Hoopoe (Local migrant).
December	2.	Yellow-Throated Sparrow (Local migrant).

Most species were a week or so later in arriving this season than usual.

Coovercolly,
Somwarpet, Coorg.
December 31, 1934.

F. N. BETTS.

XXVIII.—AN ADDITION TO THE LIST OF SNAKES OF BOMBAY AND SALSETTE: *CORONELLA BRACHYURA*.

I am sending you under separate cover a specimen of *Coronella brachyura* which I recently obtained at Marole, in Salsette Island. This species is not listed in Mr. Prater's *Snakes of Bombay Island and Salsette*.

Another snake that does not appear to have been recorded from our Island is *Typhlops acutus*. There are two specimens of this snake in the collection at St. Xavier's College, Bombay, one obtained by Mr. C. McCann at Tulsi, and the other by myself at Andheri.

Trimeresurus anamalensis is recorded as 'straying into Mahim wood' by Vidal (*J.B.N.H.S.*, v, p. 65). Does the specimen exist? or is it to be considered as a result of confusion with *gramineus*?

Godrej House,
Andheri.
April 23, 1935.

HUMAYUN ABDULALI.

[*Coronella brachyura*, a rare snake has hitherto been recorded only from the Deccan. Its discovery in Salsette indicates an extension of its range into the Konkan. It is probable that Vidal's record of the occurrence of the Anamalay Viper *T. anamalensis* in Mahim is the result of a confusion with the Common Green Pit Viper (*T. gramineus*). The latter is found in the hills of Salsette. One was killed at Malabar Hill, Bombay, where it was found in a grass cart. Snakes are sometimes imported in this way. There is in the Society's collection a hatchling of a Malay Python (*P. reticulatus*) which was killed while unloading teak from a ship in the Bombay Docks.—Eds.].

XXIX.—A FURTHER LIST OF SNAKES FROM AHMEDNAGAR.

In continuation of my note on 'Snakes at Ahmednagar' published in the *Journal of the Bombay Natural History Society* on 15th November 1932, this note is sent, which covers a period of about 14 months, from 8th June 1932, on my return from leave, to 3rd August 1933, when I was transferred to Belgaum as Civil Surgeon. During this time an additional number of snakes was seen by me—230 from the Town and District of Nagar. This brings the total number of snakes seen from this district, including those mentioned in my previous note, to 479 and hence is useful as a general index of the variety of snakes found in this part, the number being sufficiently large for this purpose. Out of the 230 snakes, 39 were from Visapur, 36 from Newasa, 6 from Jamkhed, 3 from Shevgaon, 2 from Parner and 1 from Toka, in Ahmednagar District.

The snakes were:—

1. The Common Blind Snake (*Typhlops braminus*)—9. 8 of these were found in my (Civil Surgeon's) bungalow.

2. The Red Earth-Boa (*Eryx conicus*)—11. 6 of these were from Nagar and 5 from the District. The longest was 2 ft.

3. Python (*Python molurus*)—1. This was 7 ft. long and was brought from Kharda in the District and was seen with a snakeman.

4. Checkered Water-Snake (*Tropidonotus piscator*)—7. 6 from the District and 1 from Nagar.

5. Buff-Striped Keel-back (*Tropidonotus stolatus*)—1. A complete cast skin of this snake was seen.

6. Green Keel-back (*Macropisthodon plumbicolor*)—49. 27 from Nagar and 22 in the District. In my last note I had mentioned 32, so it is quite a common snake (81 out of 479). The hatching period of this snake seems to be the month of June as young specimens 7 in. and 8 in. long were commonly seen in June and July.

7. Common Wolf Snake (*Lycodon aulicus*)—28. 22 from Nagar and 6 from the District. Another common snake (76 out of 479). A brood of 6 young ones, about 8 in. long, was found in one of the rooms of the Ahmednagar Club on 22nd May 1933,

8. Dhaman (*Zamenis mucosus*)—12. 9 from Nagar and 3 from the District. The longest was 8 ft., another being 7 ft. 8 in.

9. Fasciolated Dhaman (*Zamenis fasciolatus*)—5. One from Nagar and 4 from the District, all from Visapur, where this seems to be a common snake.

10. The Spotted or the Graceful Dhaman (*Zamenis gracilis*)—4. 2 from Nagar and 2 from the District.

11. The Trinket Snake (*Coluber helena*)—22. A common enough snake (total number 56). 16 were from the Town and 6 from the District. In the Town of Nagar this is a common snake. The longest was 50 in., some other big ones being 47½ in., 46 in., 44 in. and 42 in. One 38 in. long was seen on the ledge of the deep well in my compound, about 4 ft. from the surface of the water and was brought up alive, entangled on lowering some small branches of the ordinary Ber tree on a rope, on 8th December 1933.

12. The Common Brown Tree Snake (*Dipsadomorphus trigonatus*)—21. 11 from Nagar and 10 from the District. A fairly common snake (total number 55). One good fresh live specimen was secured from the well in my compound on 17th November 1932 where it was seen swimming. It was brought up entangled on Ber twigs (*Zizyphus jujuba*, Natural order, *Rhamnaceae*). The well has a wall about 3 ft. high and the snake must have fallen in the well from an overhanging Pilu tree (*Salvadora persica*, Natural order, *Salvadoraceae*), where probably it went in search of bird's eggs.

Two were also seen swimming in the well in the Dispensary at Shevgaon, whence they were also brought up alive.

13. The Common Kukri Snake (*Oligodon subgriseus*)—2. 1 from Nagar and 1 from the district.

14. The Banded Kukri Snake (*Simotes arnensis*)—2. 1 from Visapur in the District and 1 from the well in my compound, where it was seen swimming on 17th November 1932 and was brought up similarly to the common Brown Tree Snake mentioned in 11 above and on the same date.

15. The Three-striped Coral Snake (*Callophis trimaculatus*)—2. From the district—1 from Newasa and 1 from Visapur.

16. The Common Krait (*Bungarus caeruleus*)—9. 2 from Vispaur in the District and 2 were from my bungalow compound; 1 from the compound of the Indian Military Hospital. One was found at 3 a.m. in the engine room of the City Electric Supply Co. One 9 in. long was found on 17th July 1932. The hatching period of this snake here seems to be the months of June and July.

In my last note I had mentioned that no kraits were found on the south side of Bhingar Nullah, but in this lot, 4 were found on the south side and 3 on the north of the nullah, showing that its distribution is not limited to either side.

17. The Cobra (*Naia tripudians*)—27. 15 from near Nagar and 12 from the District. 1 wheaten-coloured from Kharda. The others were dark coloured. All were binocellate. The longest was 62 in., the other big ones being 56 in., 48 in. and 43 in.

18. The Russell's Viper (*Vipera russelli*)—4. All from the District. 3 from Newasa and 1 from Toka, six miles from Newasa, where the River Pravara joins the Godavari River.

19. The Phoorsa (*Echis carinata*)—8. All these were found in one place only in the District, at Newasa, which is on the River Pravara. They were all found in the Dispensary compound which is very near the bank of the river. If anyone wishes to get Phoorsas in this district, this is a place to remember.

These were all the 19 species found and mentioned in my last note. Four other species were also found in this new collection. These are:—

20. *Typhlops porrectus*. A variety of blind snake, not recorded from this District before. It was seen at Jamkhed Dispensary in the District on 19th January 1933.

21. Spot-bellied Polyodont (*Polyodontophis subpunctatus*)—3. 2 from Nagar and 1 from Newasa in the District.

22. Yellow-spotted Wolf Snake (*Lycodon flavomaculatus*). Only 1 specimen was found near Cursetjee's shop in the Ahmedabad Cantonment on 29th November 1932. This is the first one recorded from Nagar though it has been recorded from Poona, Nasik, Dharwar, Sangli, in the Western Ghats.

23. *Coronella brachyura*. One specimen of this from Visapur in the District was seen on 1st December 1932. This is considered a rare species as only three specimens were recorded until recently (from Poona and Berar). Dr. Lindberg from Kurduwadi, Sholapur District, in his note in the *Bombay Natural History Society Journal* of November 1932 on 'Snakes on the Barsi Light Railway' mentioned that he collected 10 of these. So this species is not so rare as it was made out to be but is fairly common in the Deccan and probably in the adjoining parts of Berar. But being a small thin snake few persons kill it or preserve it. The specimen I got in Visapur is in the British Museum now.

POONA. K. G. GHARPUREY,

June 23, 1934. *Lt.-Col.*, I.M.S.,

Offg. Surgeon-General with the Govt. of Bombay.

XXX.—MATING OF THE HAMADRYAD OR KING COBRA (*NAIA BUNGARUS* SCHLEG.).

On the 28th instant at 5-30 p.m., after returning from a walk I was ascending the hill leading to my bungalow, which is 80 ft. above the alluvium flats, a coolie drew my attention to what I would describe as a bundle of snakes, all entangled, coming down the hill towards me. On making closer investigation, I found it was two Hamadryads mating. I immediately sent for my gun and the first shot hit the smaller one of the two, which at once fastened its fangs on to the larger one. The second shot hit the big one in the centre of the back and it in turn seized the smaller one by the head. The third shot into the hood finished him off.

Both snakes were jet black in colour, with bluish markings underneath. The inner side of the hoods were yellow with a tinge of red around the edges. The measurements of the bigger one were as follows:—

Length.	12 feet 10 inches.
Circumference.	10 inches.
Width of head.	3½ do.
Width of hood.	1 foot 2 inches.

I might mention that when the hood was measured, it was not unduly stretched.

I only measured the length of the small one which was 8 ft. I have had the heads of the snakes cut off and placed in a covered basket in a stream and when the flesh has fallen away, I shall forward the skulls for your inspection.

As old Karen and Burman jungle folks have informed me that they have never come across a Hamadryad the length and size of the larger one I shot, it would be interesting to know if this is anything like a record.

PALAW,
Via MERGUI.
January 31, 1935.

W. J. L. SMITH,
Manager,
Malayan and General Trust (1933), *Ltd.*

[The largest known Hamadryad, the skin of which is in the collection of the Society, measured 15 ft. 5 in. Col. Wall records two specimens of over 14 ft. There is a reference to an 18 ft. specimen in Ditmar's *Snakes of the World.*—EDS.]

XXXI.—OCCURRENCE OF *DIPSADOMORPHUS MULTIMACULATA* SCHLEG. IN ASSAM.

An example of this snake was sent to the Society for identification by Major C. S. P. Hamilton, Chief Medical Officer, Juri Valley Medical Association, Juri, South Sylhet, Assam. Boulenger, *Fauna of British India*, 'Reptiles', p. 361, limits the distribution of this species to Burma, Southern China, Siam, Malay Peninsula and Archipelago.

BOMBAY NAT. HIST. SOCIETY.
February 15, 1934.

S. H. PRATER,
C.M.Z.S.

XXXII.—THE COMMON CHAMAELEON (*CHAMAELEON ZEYLANICUS* LAURENTI) IN GUJARAT.

I noticed a note in Vol. xxxvi, No. 2 by Mr. Acharya on the unfrequent occurrence of *Chamaeleon calcaratus*[1] in Gujarat. It might interest readers to know that in July 1933 our servants caught a very fine and large specimen in a Nim tree beside the bungalow in our compound in Borsad. He was very friendly and we even managed to get a photograph of him which however would not bear reprinting owing to the dullness of the monsoon day.

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[1] [*Chamaeleon calcaratus* Boulenger is now considered a synonym of *C, zeylanicus* Laurenti.—Eds.]

Again in September 1934 a young one was caught at the College. He was full of fun and walked all over me without showing any anger or fear except when he noticed the tiny coloured flowers on my frock, when he puffed himself out and spat and tried to snap at what he must have thought were wonderful insects which would make a delicious meal!

These are the only two I have seen in nine years in Gujarat.

MARY BROWN MEMORIAL TRAINING COLLEGE,
BORSAD.
February 7, 1935.

AGNES T. BARRY,
Principal.

XXXIII.—RATE OF GROWTH OF THE MUGGER [*CROCODILUS PALUSTRIS* (LESSON)].

On the 1st June 1915, I secured a baby mugger 11 in. long, which had recently left the egg. I kept it in the vivarium of the Museum where it lived for over 19 years, growing yearly at the rate of 2 to 9 in. or a rough average of 4 in. yearly. As it had attained to over a length of 7 ft. and as no suitable accommodation could be secured for it locally I have presented it to the Victoria Gardens, Bombay.

CENTRAL MUSEUM, NAGPUR.
November 15, 1934.

E. A. D'ABREU,
F.Z.S.

XXXIV.—BUTTERFLIES OF LAHORE.

I have read Brigadier W. H. Evans's comment on my reply to his original note on my paper on the 'Butterflies of Lahore' (*Bulletin of the Department of Zoology*, Panjab University, vol. i, pp. 1-61, pl. i-iv, April 1931) published in the *Journal of the Bombay Natural History Society*, vol. xxxv, No. 4, dated 15th July 1932. I would once more emphasize the fact that only one specimen each of the four species under discussion was collected by me from Lahore. It is not certain whether those species occur in a wild state in Lahore or the specimens I collected had been imported from elsewhere.

According to Brigadier Evans 'Mr. Antram's record of *Melitaea didyma* from the Punjab is certainly incorrect'. I may point out that the above species has been recorded from the Punjab by Bingham also (*Fauna of British India*, 'Butterflies', vol. i, 1905, p. 454).

Brigadier Evans's remark that the species which Mr. Rhe-Philipe missed from Lahore and which were subsequently collected by me 'have doubtless existed there for centuries' seems to imply that the butterfly fauna of a locality does not undergo any change.

Such an assumption would not be in accordance with observed facts.

GOVERNMENT COLLEGE,
LAHORE. D. R. PURI.
December 5, 1932.

[Mr. Puri states that only one specimen each of the four species under discussion was 'collected' by him in Lahore. In the next sentence he states that he is not certain whether these species occur in the wild state in Lahore or whether they had been imported from elsewhere. His 'collecting' may therefore suggest that the specimens in question might have been given him by someone who may have 'said' that he had got them in Lahore. It seems difficult otherwise to explain Mr. Puri's statement that 'it is not certain whether those species occur in wild state' in Lahore.

As regards *Melitaea didyma*, the Punjab species is actually *trivia* and the distribution of *didyma* does not extend to the plains.

Mr. Puri suggests that the Punjab may slowly change its fauna, but changes of the nature implied by the author of the note do not occur such as the sudden influx of butterflies from thousands of miles away or the descent of high elevation insects to the Indian plains.—EDS.]

XXXV.—MIMICRY: BEING NOTES ON CERTAIN INDIAN BUTTERFLIES.

On page 529 of his classic *Butterfly Hunting in Many Lands*, Dr. Longstaff writes: 'It may not be without interest to record a number of cases in which a collector with defective eyesight has actually been deceived (at any rate momentarily) by mimics in the field'. It is hoped that the following brief notes by a collector, who prides himself on the keenness of his sight, may prove of equal interest.

Papilio polytes, L. ssp. *romulus*, Cr. female and *Byasa hector*, L. female. A good cabinet mimic. I have never seen the two species flying together, in fact the only living *hector* I have seen were males, but their flight seemed more direct and businesslike than that of the mimic. It is of course possible that the females fly in a more hesitating manner.

Papilio polytes, L. ssp. *romulus*, Cr. ♀ f. *stichius*, Hbn. and *Byasa aristolochiae*, F. *aristolochiae*. This form is usually described in books as the '*aristolochiae* form of female'. It is, in my opinion, a poor cabinet mimic and an even less convincing field one. Both its flight and general appearance are unlike the so-called model and I have never been deceived, even momentarily, by it.

Chilasa clytia, L. *clytia* and *Euploea core*, Cr. *core*. *Chilasa clytia*, L. f. *dissimilis*, L. and f. *dissimillima*, Evans and *Danais limniace*, Cr. ssp. *mutina*, Fruhs. These are not over convincing mimics when seen in the cabinet. In flight, however, they are almost perfect, so much so that I have given up recording cases where I have been deceived by single specimens. I once even caught two *E. core* and one *C. clytia* with one stroke under the impression that I was catching three of the *Euploea* (vide *Entomologist,* lxvi, p. 119). The slow sailing flight of the mimic, when undisturbed, is an exact imitation of that of the model; if frightened, however, it dashes off with the typical Papilionid flight. When at rest on flowers they are easily distinguished as the mimic keeps up an incessant fluttering whilst the model rests either with the wings motionless or slowly opens and shuts them.

Pareronia valeria, Cr. ssp. *hippia,* F. female and *Danais aglea,* Cr. I have coupled these two species together as there is no other Danaid small enough to act as model, but I have never seen them flying together. They are a fairly good cabinet pair and the Pierid has the typical Danaid flight. Dr. Longstaff records having mistaken the female of *Pareronia ceylonica,* Feld. for this Danaid in Ceylon.

Elymnias hypermnestra, L. ssp. *undularis,* Drury, female and *Danais plexippus,* L. A fair cabinet mimic. It is not, however, very convincing in the field as the flight is very much weaker than that of the model. It also settles frequently and shews the non-Danaine underside.

Elymnias malelas, Hew. *malelas* male and *Euploea* sp. The only specimen I have seen alive was caught whilst touring near Darjeeling under the impression that it was one of the blue Euploeas.

Hestina nama, Dbl. and *Danais tytia,* Gray, *tytia.* A good cabinet pair. I have never seen the Danaid alive but I was completely deceived by the mimic when first I met it and was surprised to find that I had caught a Nymphalid and not a Danaid.

Hypolimnas misippus, L. female and *Danais chrysippus,* L. An almost perfect cabinet mimic and equally good in the field. I have a specimen which was caught after being watched some time, both flying and at rest, and which was only recognised as a Nymphalid when it was being papered.

Argynnis hyperbius, L. *hyperbius* female and *Danais chrysippus,* L. A poor cabinet mimic of either *D. chrysippus,* L. or *D. plexippus,* L. On the wing it resembles a brown *Danais* but the resemblance is not definite enough for it to be mistaken for any given species.

LONDON. D. G. SEVASTOPULO,
August 21, 1933. F.R.E.S.

XXXVI.—A PRELIMINARY LIST OF THE *PYRALIDAE* OF CALCUTTA.

Most local lists are concerned with the Rhopalocera, so a list of one of the more neglected families of the Heterocera may be of interest. The *Pyralidae* listed below have all been caught at light in the heart of Calcutta during the last three years. Hampson, whom I have followed as regards nomenclature, names 1,136 species of *Pyralidae* in the fourth volume of Moths in the *Fauna of British*

India, published in 1896. My list consists of 91 species and I still have a fair number awaiting identification.

Galleria mellonella, L.
Ancylolomia chrysographella, Koll.
Ramila marginella, Moore.
Scirpophaga auriflua, Zell.
Schoenobius immeritalis, Wlk.
,, *bipunctifer*, Wlk.
,, *adjurellus*, Wlk.
,, *incertellus*, Wlk.
Cirrhochrista brizoalis, Wlk.
Euzophera perticella, Rag.
Nephopteryx paurosema, Meyr.
,, *leucophaella*, Zell.
Phycita hemixanthella, Hmpsn.
Hypsopygia mauritialis, Boisd.
Pyralis pictalis, Curt.
,, *manihotalis*, Guen.
Tamraca torridalis, Led.
Herculia nigrivitta, Wlk.
,, *igniflualis*, Wlk.
,, *suffusalis*, Wlk.
Nymphula crisonalis, Wlk.
,, *fluctuosalis*, Zell.
,, *depunctalis*, Guen.
Oligostigma bilineale, Snell.
Talanga sexpunctalis, Moore.
Hymenoptychis sordida, Zell.
Tatobotys varanesalis, Wlk.
Bradina admixtalis, Wlk.
Hydrorybina bicolor, Moore.
Pycnarmon virgatalis, Moore.
,, *caberalis*, Guen.
,, *meritalis*, Wlk.
Zinckenia fascialis, Cram.
Eurrhyparodes tricoloralis, Zell.
,, *bracteolalis*, Zell.
Agrotera basinotata, Hmpsn.
Pagyda traducalis, Zell.
Ercta elutalis, Wlk.
,, *ornatalis*, Dup.
Cnaphalocrocis medinalis, Guen.
Marasmia venilialis, Wlk.
,, *trebiusalis*, Wlk.
,, *trapezalis*, Guen.
Syngamia floridalis, Zell.
Bocchoris acamasalis, Wlk.
Dichocrocis evaxalis, Wlk.
Ceratarcha umbrosa, Swinh.
Botyodes asialis, Guen.
,, *flavibasalis*, Moore.
Sylepta aurantiacalis, Fisch.
,, *lunalis*, Guen.
,, *derogata*, Fab.
Lygropia quaternalis, Zell.
Agathodes ostentalis, Hubn.
Glyphodes laticostalis, Guen.
,, *negatalis*, Wlk.
,, *psittacalis*, Hubn.
,, *hilaralis*, Wlk.
,, *marginata*, Hmpsn.
,, *vertumnalis*, Guen.
,, *unionalis*, Hubn.
,, *stolalis*, Guen.
,, *bivitralis*, Guen.
,, *caesalis*, Wlk.
,, *canthusalis*, Wlk.
,, *pyloalis*, Wlk.
,, *bicolor*, Swains.
,, *indica*, Saund.
Pygospila tyres, Cram.
Euclasta defamatalis, Wlk.
Lepyrodes neptis, Cram.
,, *geometralis*, Guen.
Analyta sigulalis, Guen.
,, *melanopalis*, Guen.
Leucinodes orbonalis, Guen.
,, *apicalis*, Hmpsn.
Crocidolomia binotalis, Zell.
Sameodes cancellalis, Zell.
Archernis tropicalis, Wlk.
Terastia meticulosalis, Guen.
Isocentris filalis, Guen.
Maruca testulalis, Geyer.
Tetridia caletoralis, Wlk.
Pachynoa sabelialis, Guen.
Pachyzancla licarsisalis, Wlk.
Antigastra catalaunalis, Dup.
Noorda blitealis, Wlk.
,, *fessalis*, Swinh.
Pionea albicostalis, Swinh.
,, *leucanalis*, Swinh.
Pyrausta incoloralis, Guen.

CALCUTTA.
January 8, 1935.

D. G. SEVASTOPULO,
F.R.E.S.

XXXVII.—A NOTE ON *ELYMNIAS HYPERMNESTRA UNDULARIS*, DRURY.

The hatching of the larva of *E. hypermnestra undularis* is sufficiently unusual to merit recording.

Lepidopterous larvae, as a general rule, escape from the ovum by eating an untidy hole in the shell, through which they emerge. The subject of this note, however, does not act in this way but instead cuts neatly round the ovum, about three-quarters up from the base, making a hinged cap. This is presumably forced open by the larva and then falls back into place. The larva rests beside the apparently intact eggshell for a few hours and then eats it as its first meal.

This is the only species of Satyrid that I have bred from ova, so I cannot say if this habit is usual in the family. If it is, I have never seen it recorded. No other Lepidopteron that I have bred has treated the egg in this way.

Since writing my note on the hatching of the larva of this species, I have received a specimen page, describing the life-history of *Satyrus* (*Melanargia*) *galathea*, L., from *The Complete Book of British Butterflies* by F. W. Frohawk.

In this Mr. Frohawk writes: 'Upon hatching, the young larva eats round the crown of the egg, cutting out a large circular lid, and pushes it off upon emerging'. This habit may, therefore, be more or less general among the Satyridae.

CALCUTTA. D. G. SEVASTOPULO,

January 8, 1935. F.R.E.S.

XXXVIII.—WAX-PRODUCTION IN MEALY BUGS: *ALEURODIDAE*.[1]

The secretion of wax is a very commonplace phenomenon in many of the *Homoptera* and is particularly noticeable in all the families of *Sternorhyncha*. Wax is secreted by special structures known as *wax-glands*, *wax-cells* and *wax-pores*. The arrangement, position and structure of these may differ in different families. The secretion of wax is found in the larval as well as in the adult stages. In the family *Aleurodidae*, wax-secretion is profuse in the adults of all the species, but not found to the same extent in the larvae. Generally three types of wax-pores are found in the larvae of *Aleurodidae*: (1) simple, (2) agglomerate and (3) compound. The structure of the simple and compound wax-pores is as follows:—

Simple wax-pores are circular holes of small or large size in diameter from .017 mm. to .027 mm. These exist in greater numbers in those species which secrete a large quantity of wax. In compound pores the holes have a chitinous ring surrounding them and a definite elevated cup-like structure. Within the cup the pores are arranged in a ring and are produced into more or less elevated rods or tubes.

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[1] These observations were made on *Trialeurodes vaporariorum*—the greenhouse white fly—at Edinburgh, under Dr. C. B. Williams, now the Chief Entomologist, Rothamsted, England.

In the adults there are chitinous plates which are placed ventrally on the abdominal segments and are known as wax-plates. These may be comparable to the wax-plates in honey bees. There are two pairs of these plates in the female placed on the third and fourth segments respectively, and four pairs in the male on the third, fourth, fifth and sixth segments. These wax-plates appear like thick pads and are oily yellow in appearance. They are separated by a median line in the centre of the abdomen but extend considerably outwards on both sides so that they can be very clearly seen laterally as they are bounded by a black line.

In the female both the plates appear to be equal in dimensions, but in the male the first one is bigger and the succeeding ones gradually reduced in size. When viewed under microscope these present an appearance of plates possessing minute holes arranged in regular rows.

When highly magnified (1,200 times under the oil-immersion lens) these holes appear like cells in a honeycomb. These are the minute circular pores through which wax comes out or is forced out in small minute particles or threads. In thin microtome sections taken through these wax-glands there is seen a single layer of secreting cells with large nuclei which contain vacuoles. There are numerous granules in these vacuoles which are found in a large number towards the outer side.

A careful examination of these plates in a male of *T. vaporariorum*, under a very high magnification, shows that each of the last three plates contains 40 rows of 90 cells each at an average; the first one has 50 rows as it is larger. Thus the total number of pores of one side comes to 3,600 × 3 = 10,800 plus 50 × 90 = 4,500 = 15,300 or approximately 15,500 and both the sides together will bring the number to 31,000. Each side on the abdomen the space occupied (longitudinally) is .3 mm. In the female there are only two pairs of plates which are rather broader and occupy space to the extent of .23 mm. each side. Each of the plates contains pores in rows of 63 × 95 and 60 × 95 cells respectively. The total number of pores on one side thus comes to 11,685 or nearly 12,000. It is not understood why the number of pores is less in females.

Freshly hatched specimens are perfectly free from any wax particles soon after emergence. The wax-plates, not being at work, cannot be marked out very clearly.

I give below my observation on a specimen for about 5 hours from its emergence. It was a male. It extricated itself with great difficulty from the pupal case which operation took it about an hour. This was at 10 a.m. In the first two hours no wax was seen being secreted but only the wax-plates assumed an oily olive appearance.

Then one of the plates (on the left side) was seen covered with white flocculent material which soon after drying became white.

The insect (which was under a binocular) was actively moving its legs first of one side and then of the other. In this way the legs actually brushed off the wax accumulated on the plate and by dashing the legs here and there it distributed the wax or the meal all over its body.

As the plates on the left side were active, the left side of the body was covered with wax, first the abdomen and its end, then the underside of the wings and then the front part of the body. Gradually all the plates began to secrete wax which was being spread all over the body. All the plates were in full action by 3 p.m. i.e. 5 hours after emergence.

The structure of the meal or the wax secreted is very peculiar. It is in the form of spiral threads as if forced out through small holes, but under abnormal conditions, or if the meal is not constantly removed by the brushes on the legs, it assumes the form of long threads appearing like silken combs or tufts. While observing the eclosion of flies from the pupae, I have seen several specimens with three-fourths of their body out and struggling hard to extricate the last part of the body. The insect stands erect and dashes its legs in the air; with wings in the unexpanded condition. The wax-plates are active and the wax begins to appear on the body. As no brushing off is possible in that condition, the wax goes on accumulating and a very thick brush-like layer is formed.

Under the microscope these appear like bunches of long threads with one end curved. I have also observed cases of partial emergence wherein the flies have died after the upper part of the body —head and thorax—having come out, the abdomen remaining inside the pupal case. In such cases I have found after pulling out the abdomen that it was full of waxy brushes, proving thereby that the wax-plates were actively secreting wax even though the abdomen was enclosed in the pupal covering.

DEPARTMENT OF AGRICULTURE, V. G. DESHPANDE,
BOMBAY. M.Ag. (Bom.), Ph.D. (Edin.).
January 8, 1935.

XXXIX.—AN ANNOTATED LIST OF INDO-CEYLONESE TERMITES.

Since the publication of the Catalogue of Indo-Ceylonese Termites (vol. xxvii, No. 3) the writer has come across a paper on 'New Termites from India' by Thomas E. Snyder (*Proceedings of the United States National Museum*, vol. 82, Art. 16, pp. 1-15, pl. 1, 1933). The paper deals with the following species:—

Fam. *Kalotermitidae*: *Kalotermes* (*Neotermes*) *andamanensis*, Snyder. A new species, from North Andaman Island. 'Close to *Kalotermes* (*N*) *greeni*, Desneaux of Ceylon.'

Kalotermes (*Neotermes*) *bosei*, Snyder. From Mathranwala, Dehra Dun, United Provinces, India. 'ex. *Ficus* sp.'

Kalotermes (*Neotermes*) *gardneri*, Snyder. From Dehra Dun. 'ex. rotten *Mangifera indica*.'

Fam. *Rhinotermitidae*: *Heterotermes malabaricus*, Snyder. From 'South Mangalore, 400 ft. Malabar Coast.'

Fam. *Termitidae*: *Termes* (*Termes*) *dehraduni*, Snyder. Also from Dehra Dun.

Termes (*Termes*) *malabaricus*, Holmgren. Also from Dehra Dun.

Termes (*Cyclotermes*) *almorensis*, Snyder. 'West Almora Forest Division, United Provinces, India. Altitude 5,000 ft.'

Microtermes pubescens, Snyder. From 'Dehra Dun, United Provinces, attacking aerial roots of *Ficus bengalensis*.'

Nasutitermes (*Nasutitermes*) *fletcheri*, Holmgren. Recorded from 'Anamalai Hills, 2,400 ft., Madras.'

Nasutitermes (*Rotunditermes*) *anamalaiensis*, Snyder. 'Anamalai Hills, 2,400 ft., Madras.'

Nasutitermes (*Subulitermes*) *gardneri*, Snyder. 'Rangirum, Darjeeling, Bengal, India, in rotted wood at an elevation of 6,000 ft.'

Microtermes beesoni, Snyder. 'Chakata Range, Haldwani, United Provinces, India.'

Microtermes championi, Snyder. 'Haldwani District, Kumaon, United Provinces, India.'

All the above ones, except *Nasutitermes* (*Nasutitermes*) *fletcheri*, Holmgren and *Termes* (*Termes*) *malabaricus*, Holmgren, are new species described by Snyder.

Agricultural Research Institute,
Lawley Road, Coimbatore. V. MARGABANDHU.
November 27, 1934.

XL.—A NOTE ON THE DISTRIBUTION, OVIPOSITION AND PARENTAL CARE OF *SCUTIGERELLA UNGUICULATA* HANSEN VAR. *INDICA* GRAVELY.

(*With two text-figures*).

Soon after the first few monsoon rains in 1932 I collected from Kovalam[1] a number of specimens of *Scutigerella unguiculata* Hansen var. *indica*, which Gravely recorded from Calcutta (4)[2].

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[1] Seven miles to the south of Trivandrum near the coast.

[2] The number in brackets denotes the literature referred to.

Later on when collecting cryptozoic forms from various places near Trivandrum and also from Ponmudi hills (3,500 ft. above sea-level in the Western Ghats), I found that it occurred fairly abundantly in all wet situations under stones, and under rotting leaves and timber.

As this variety recorded from Calcutta occurs in the southern extremity of India it is probable that it may be distributed in the intermediate regions also. Gravely in a footnote (4) says that he had found this form in Kandy and Pattipola in Ceylon and adds that Green had told him about a similar looking centipede that he had seen at the top of Namunukuli hill and says that it is probable that it is widely distributed throughout the Island. Last March I myself collected this variety from Kandy and from various parts of the Uva Province including Passara (3,000 ft.) at the foot of the Namunukuli hill, and am in a position to confirm the opinion of Gravely regarding its wide distribution in the Island of Ceylon.

The species *subunguiculata* Imms is recorded from Danaulti in Tehri Garhwal. It is the only species of *Scutigerella* recorded from India (3). *Scutigerella unguiculata* Hansen is from La Moka, Venezuela (2).

Habits.—These active little creatures avoid light. The specimens are not found during summer but suddenly make their appearance in large numbers as the rainy season commences. A specimen that I kept in a small tube three months ago with a small quantity of moist earth is still living.[1] The only food it had since then is the blue green alga formed inside the tube. I have reared a number of specimens and have never found them to be predaceous.

Oviposition.—The animal lays five to nine eggs at a time. I have seen the captive animal laying the eggs in groups of two or three in a careless manner whereas in natural conditions they are laid in a single cluster. The eggs are held together though not very firmly.

Each egg is imperfectly oval with a number of projections resembling a morous fruit (fig. 1). These projections are formed by the silken network that the animal spins on the surface with the aid of its cerci. Wherever the silken threads reticulate a projection is found. Figure 2 shows the photomicrograph of an egg-mass mounted in balsam. The silken network has dissolved and the eggs have moved apart. It is probable that the secretion from the cerci is of a fatty nature.

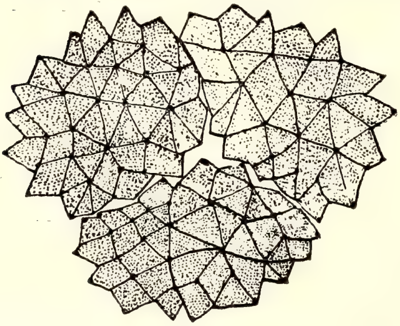

FIG. 1. A cluster of three eggs.

Parental care.—It is particularly interesting to note that this minute creature exhibits a sort of parental care that I have observed only among the *Chilopods* in *Myriapoda*. The *Diplopods* always leave the eggs after safely depositing them. The way in which *Scutigerella* incubates the eggs is slightly different from that of the common centipedes *Scolopendra* and *Geophilus*. The *Scutigerella* simply remains over the eggs that are arranged in the manner of a disc probably till hatching time (which I have not seen). In the case of *Scolopendra* the mother bends once round the eggs and embryos and holds them together by the aid of its legs; and in the case of *Geophilus* the mother coils its long body round the eggs a number of times with the anterior end alone free.

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[1] The animal died a month after this note had been sent.

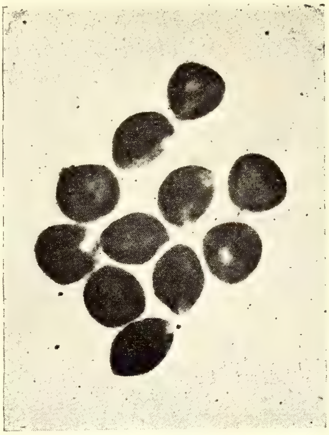

FIG. 2. Egg-mass.

Recently when a stone was turned over I saw a specimen of *Scutigerella* incubating its eggs. The creature instead of running away calmly remained near the eggs and began to eat them. This work took about five minutes, after which it began to move about actively. On examination I found that the contents of four eggs had been completely sucked, the shells alone of which remained, while the fifth one remained untouched. *Scolopendra* also behaves in a similar way but only in captivity.

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2. 1904. Hansen, H. J. 'The Genera and Species of *Symphyla*', *Q.J.M.S.* (*N.S.*), xlvii, 1904, pp. 1-101, pl. i-vii.

3. 1908. Imms, A. D. 'On a New Species of *Symphyla* from the Himalayas', *Journ. Linn. Soc.* (*Zool.*), xxx, 1909, pp. 252-255, pl. xxxi.

4. 1910. Gravely, F. H. 'On a Sub-species of *Scutigerella unguiculata* Hansen, found in Calcutta', *Records of the Indian Museum*, Vol. v, Part III, No. 15, 1910, pp. 157-159.

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September 20, 1934.

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XLI.—OBSERVATIONS ON THE OVIPOSITION AND DEVELOPMENTAL STAGES OF A SPECIES OF *POLYXENUS*.

(*With* 2 *plates*).

Since July 1933 I have been engaged in working out the anatomy and development of this Diplopod which occurs fairly abundantly in Kovalam, 7 miles to the south of Trivandrum. A detailed account of the anatomy and development is in course of preparation and will be published later.

This Pselaphognathous Diplopod (provisionally determined as a species of *Polyxenus*) is seen under stones and under the barks of trees. The adult measures from 3.5 to 4 mm. There are transverse rows of setae on the head and tergites (fig. 1). The pleurae bear setae in bundles. The sternite of the last segment which is apodal bears a thick median bundle of long setae specially constructed to serve as an organ of defence for the animal (fig. 2).

The antennae are eight-jointed, and the two laterally placed eye-groups are each composed of 8 ocelli. There are 11 trunk segments with 13 pairs of legs. Genital openings are situated behind the coxae of the second pair of legs and the anus is situated on the 10th segment.

The females are usually slightly larger than the males and especially so when distended with ripe ova. Copulation takes place many days before oviposition. In the vas deferens the spermatozoa are short and kidney-shaped and appear to be provided with a membranous covering. After the transference of the spermatozoa into the receptacula seminales of the female the membranous covering disappears and the spermatozoa grow in length.

Eggs are laid at night. The mother envelopes the egg-mass with a large number of setae from its postanal median bundle which it voluntarily dislodges for the purpose (fig. 3). This setal envelope efficiently helps to scare away the egg-eating enemies which in this case is a microscopic mite belonging to the family *Tyroglyphidae* and a Neuropteran insect belonging to the family *Psoscidae* commonly known as a book-louse.

Usually 20 to 40 eggs are laid in the form of a plate one layer thick. The eggs are oval or kidney-shaped and measure 0.32 mm. long and 0.18 mm. broad and are arranged vertically with their broader side up.

About nine days after the eggs are laid the eggshell ruptures in the middle transversely and there wriggles out from it the pupa which remains quiescent for seven days.

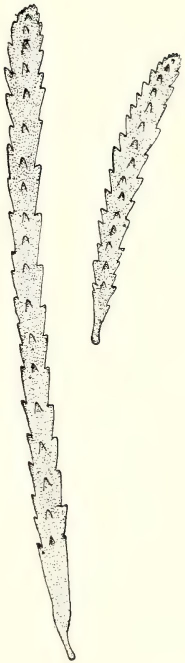
The pupa is encased in a thin membrane formed by a secretion of the embryonic ectodermal cells. The surface of the pupa is tuberculated. Rudiments of antennae, limbs and pleural projections are seen as small buds.

(It may be stated here that the presence of a pupal stage in the life-history of *Pselaphognatha* has not been recorded by any of the previous workers on this group.)

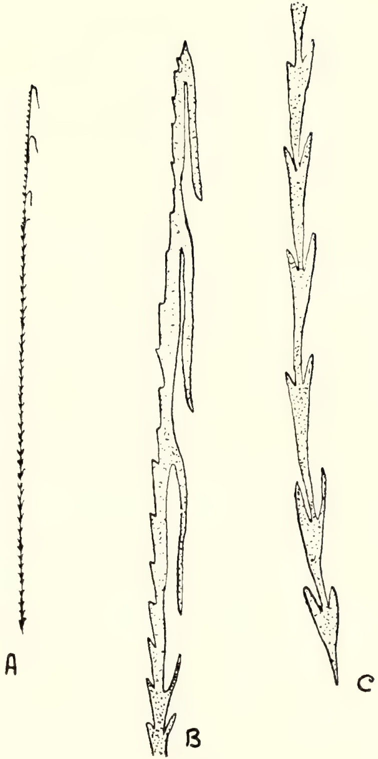
On the fourth day 5 simple ocelli develop on each side of the pupa. The pupa which is at first pure white in colour acquires a brownish tinge.

On the seventh day the pupal membrane ruptures in the region of the head and a tiny white larva bearing 3 pairs of legs comes out and actively moves about and feeds.

The stages of the larval development are shown in the tabulated form. The interval from moult to moult is very variable. It



1



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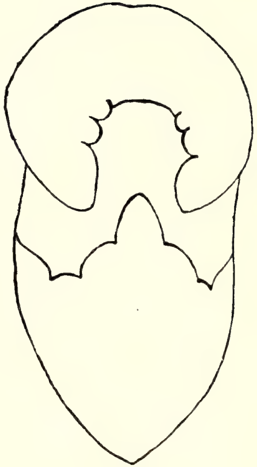
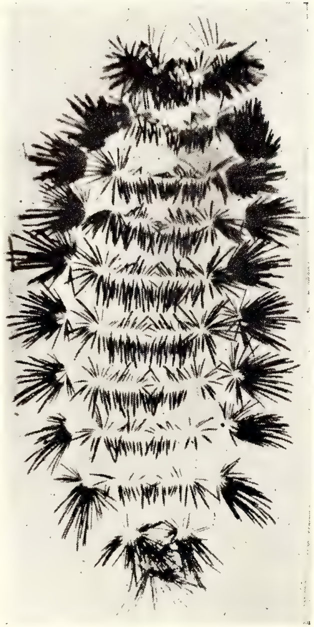


3

1. Ordinary setae. 2. Defensive setae.
3. Pupa, front view (mag. ×170).



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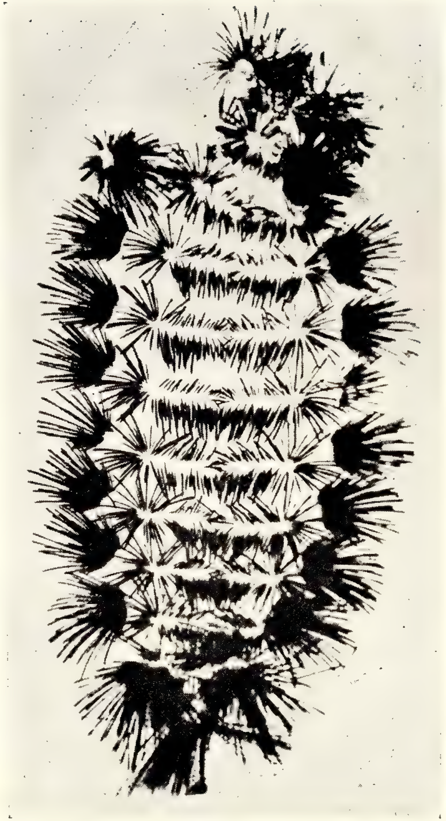

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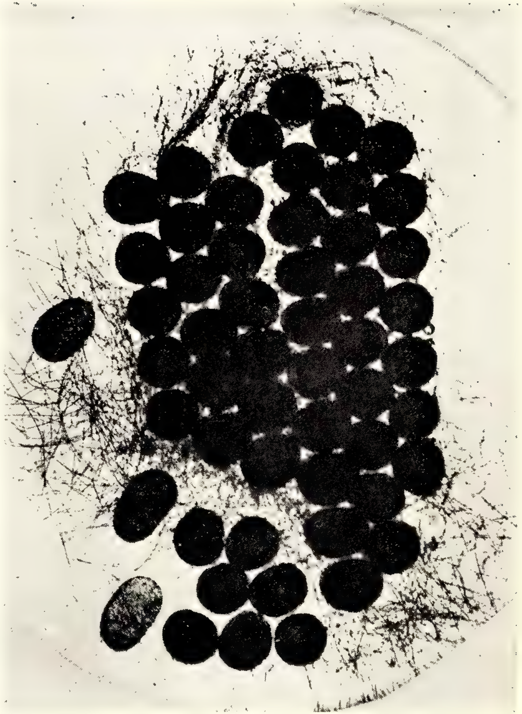

6

4. Moult of male. 5. Moult of female. 6. Egg mass with the setae all round.

depends on the quality of food supplied and other conditions of rearing. In the later stages there is a progressive increase in the intervals between the succeeding moults.

Stage.	No. of Tergites.	No. of paired legs.	Presence of ext. reproductive openings.	Time taken for next moult.
I ...	5	3		14 days.
II ...	5	4		16 ,,
III ...	6	5		3 weeks.
IV ...	7	6		3 to 4 weeks.
V ...	8	8		4 to 7 ,,
VI ...	9	10	♂ ♀	7 to 10 ,,
VII ...	10	12	♂ ♀	7 to 10 ,,
VIII ...	11	13	♂ ♀	8 to 10 ,,

The animal continues to moult even after acquiring the full complement of segments and appendages. The details of the developmental stages of *Polyxenus* represented in the tabular statement above agree fairly closely with those of female *Polyxenus lagurus* as investigated by Reinecke.

The female becomes sexually mature only long after acquiring the full number of legs and appendages whereas the male becomes sexually mature even when it possesses only 10 segments and 12 pairs of legs. During moulting the old setae are all shed along with the exoskeleton and the new setae that replace them are pure shining white in colour turning grey on the second day.

The figures 5 and 6 show the moults of a male, female at the VIII stage. Photomicrographed.

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S. JONES, B.A.

August 20, 1934.

XLII.—PRECOCIOUS GERMINATION.

In the 'Science Notes' of the September issue of *Current Science*[1] there is a reference to a case of abnormal development of the radicle in a perfectly ripe fruit of Mango, reported by Mr. Tara Chand Nandi. In this connection it is stated also that the probable explanation is sought by the writer to be unfavourable condition of the soil.

In the absence of the complete text, it is not clear whether germination had started on the plant, or the germinating fruit was obtained from the market. If the former, this will be perhaps the first case of its kind seen. If the latter, it should be noted that this is not at all a rare phenomenon. Such mango seeds, germinating inside the mother fruit, have been frequently observed by me, particularly from specimens obtained late in the season, or even long after the fruiting normally ends. In this connection, however, one fails to see the significance of the remark that the development of the radicle was due to unfavourable conditions of the soil. Where does the soil come in at all—much less its unfavourable effect—in these cases, is not at all clear. These are points on which one would like to have more light thrown. On the other hand, as will be shown later, such cases of precocious germination are indeed due to the particularly favourable environment of the seed. Another point that may be mentiond in connection with germination of this type is that the otherwise soft pulp becomes hard and 'knotted' in the vicinity of the germinating radicle.

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[1] *Current Science,* 1934, iii, 3, 128.

If the fruit showing the peculiarity was purchased from the market, it is to be noted that the fibreless varieties of mango, to which the *Fazli* belongs, are always artificially ripened in a packing of hay or some similar stuff. The nature of the packing material varies according to the time when the fruits are required for consumption.

Furthermore, such cases of precocious germination are not rare even otherwise. They have been seen and reported in other fleshy fruits, which specially seem to favour such germination. *Papaya* is one such. In this fruit germinating seeds have been observed not only by me, but also reported by others.[1, 3] Other fleshy fruits characterised by the same feature are: *Cacti*, *Melocanna bambusoides*,[2] *Cucurbita*, apples, tomatoes, etc.,[3] *Dracaena*, Mandarin orange, *Mermecodia*.[1]

With reference to the author's statement that such a form of germination is known in the case of viviparous mode of life, it is merely begging the question. 'Viviparous mode of life' is a somewhat vague and loose statement, not always connoting the same idea. It has been used in a wider sense to mean, for example, the uninterrupted development of the embryo, without a resting period (or a seed stage), whether or not within the fruit itself; as also in a more restricted sense, of germination in the fruit on the plant. (Mattfeld, as cited by Engler,[3] excludes under this designation the germination of the seeds altogether, including these under 'Bioteknose', and restricts it to cases of sprouting of detached shoots, buds and bulbils, in the position of flowers, endowed with the capacity of living and developing independently.) The latter, however, is the more generally accepted view.

If used in the latter sense, it should mean that the fruit with the germinating seed was obtained directly from the plant, which is not clear. If the former, then there are already a number of plants in which uninterrupted development of the germ from the fertilised egg to the complete seedling, has been reported. Some examples of fleshy fruits have already been mentioned above. But there are also *dry* fruits in which similar relation is found. Such are, for example, *Crinum* and *Cryptocoryne*,[1] among others, where there is an uninterrupted development of the germ even under ordinary conditions. Others whose seeds do not ordinarily germinate but do so when the temperature and humidity of the surroundings are high are: *Dryobalanops camphora*, wheat grains on the stalk,[1] *Ipomea glaberrima*, *I. peltata*, *Hibiscus diversifolius*, *Croton sp.*, *Luffa cylindrica*,[2] *Juncus*, *Epilobium*, *Agrostemma*, *Papaver somniferum*, *Tetranema mexicana*,[3] *Avena* sativa.[4] Mr. Joshi[5] also mentions *Atriplex* and *Suaeda*, but these were collected in wet weather in December.

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[1] Guppy, 1906. *Observations of a Naturalist in the Pacific*, ii. London.

[2] Goebel, 1923. *Organographie der Pflanzen*, iii. Jena.

[3] Engler, 1926. *Pflanzenfam.* xiv a. Leipzig.

Really speaking, vivipary is found to be, on analysis, the final expression of a continuous chain of events, beginning with the detachment of immature seed with a rudimentary embryo, and, therefore, requiring an obligatory period of rest for ripening in the soil, and ending with those seedlings which remain growing for months on the tree e.g. *Rhizophora*, *Brugiera*, etc. The intermediate links are represented by (1) those seeds which are quite mature when detached from the parent and hence ready to germinate as soon as fallen on the ground; (2) seeds which merely begin to germinate while still on the plant, but soon get detached and fall off e.g. *Laguncularia* and (3) mangrove plants where germination is completed on the tree, but the seedling is forthwith liberated, e.g., *Avicennia*. It is, in fact, a matter of small beginnings, or as Guppy[2] conceives and puts it 'a matter of small endings'. According to him it represents an adaptation to primitive condition, when in remote geological times, there was a uniform climate over the whole of the earth (an inference not wholly accepted[6]), and the resting period of the seeds is due to the differentiation of the climate and the ushering in of distinct seasons. Joshi,[7] however, demurs to his explanation and has suggested that the viviparous habit probably arose as a deviation from the normal, and that it is a device to dodge the injurious action of the saline habitat in preventing the germination of the seed in the soil. According to him the viviparous plants have become grouped together near the sea-shore, because the habit really proved useful there, characterised as it is by a constantly high salinity throughout the year.

The obligatory resting period may be due to a variety of causes. As already indicated, the seed may be detached when the embryo is still immature. In other cases the resting period may be necessary in order to complete chemical changes, known as after-ripening, which are necessary before germination can start. In still other cases (examples already cited) it may be merely facultative and determined by the physical conditions of the environment. A particularly striking example of this was reported by me[1] in the case of gram, where the sappy green seeds, under certain circumstances, may continue their uninterrupted development, although ordinarily the seeds of this plant undergo a period of rest.

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[1] Goebel, 1889. *Pflanzenbiol. Schild*, i, 117-134. Marburg.

[2] Guppy, 1906. *Observations of a Naturalist in the Pacific*, ii. London.

[3] Engler, 1926. *Pflanzenfam.* xiv a. Leipzig.

[4] Weaver and Clements, 1929. *Plant Ecology*. New York and London.

[5] Joshi, 1932. *Journ. Ind. Bot. Soc.*, xi.

[6] Seward, 1931. *Plant Life through the Ages*. Cambridge.

[7] Joshi, 1933. *Journ. Ecol.*, xxi, 1.

On an examination of the cases of precocious germination of seeds, otherwise requiring a resting period, one fact which clearly emerges, is that great humidity combined with a high temperature are predominantly associated with the phenomenon in question.[2] From this the germination of the mango seed inside the pulpy fruit is quite intelligible. The conditions under which ripening mangoes are stored, buried in a mass of hay or some similar stuff, in the steamy atmosphere of the rainy season and further enhanced by the ripening juicy pulp of the fruit itself, are most ideal for favouring and maintaining uninterrupted development of the embryo. Therefore, in these conditions it is not surprising that what appears by comparison to be precocious germination, should result. In fact, as Goebel[3] has pointed out, the absence of a resting period in inhabitants of moist localities is bound up with the fact that from their ripening seeds not so much water is withdrawn as under conditions obtaining elsewhere.[3] Analogous conditions exist with regard to the mango seed, and the same explanation would appear to apply to the case in question.

BENARES HINDU UNIVERSITY. N. K. TIWARY.

February 1935.

XLIII.—ROOT FORMATION FROM LEAF-CUTTINGS.

On pages 105-106, vol. iii, No. 3, of *Current Science* Mr. P. E. Mullik[4] records interesting observations on the development of roots from the petiole of *Ficus religiosa* leaf, noted incidentally during an investigation of an altogether different kind. In his note the author gives a brief account of the process of root-formation from the petiole of the leaves kept in tap-water as well as in Pfeffer's dilute nutrient solution. He, however, adds that when

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[1] Tiwary, 1932. *Beihefte zum Bot. Centralbl.*, xlix, 1. Dresden—N.

[2] This precocious germination is also seen in the spores of the *Bryophyta*, e.g., *Pellia*, *Androcryphia*, *Fegatella*, *Dendroceros*, all inhabitants of moist localities, the spores germinating while still inside the *sporogonium* (Goebel, 1915-1918. *Organographie*, ii, 757).

[3] Goebel, 1923. *Organographie der Pflanzen*, ii. Jena.

[4] *Current Science*, 1934, iii, 105-106.

'one of the leaves with roots was placed in moist sand to see if any shoot would come out' . . . 'it began to show signs of decay' after three days.

Mr. Mullik does not make any mention of the previous literature on the subject, though the development of adventitious roots on leaves, and even the regeneration of an entire plant by the detached leaves are of fairly general occurrence and well known to gardeners who employ them for propagating several species. In this note I propose to deal with observations of a like nature hitherto recorded by various workers.

Identical behaviour on the part of the leaves of *Fittonia verschaffeltii* placed in moist soil was recorded by Krishnamurti.[1] Subsequently Patwardhan[2] and Mullan[3] named other plants in which the phenomenon had been noticed. In later papers Isbell,[4] and Roberts and Lawrence[5] have recorded their own observations on the subject.

Moreover there exists an extensive literature in connection with the phenomenon of regeneration. This has been specially dealt with by Goebel[6] who besides recording his own interesting observations and giving interpretation of the facts, cites also previous literature. More recently, an extensive monograph on the subject of regeneration and transplantation in animals and plants has been published by Korschelt.[7]

Kerner[8] has also discussed the subject in his classical work. This author cites numerous examples of plants regenerating adventitious roots, and even developing buds on severed leaves. The latter have in consequence been extensively employed in horticultural practice. Kenner also records the development of buds on scales and floral leaves. According to him, and other authors, epiphyllous buds, stimulated to develop artificially on severed leaves, are also found naturally on some plants. *Bryophyllum* is the best known example. But many other plants exhibiting the same peculiarity and belonging to several families, in which *Cruciferae*, *Gesneraceae* and *Liliaceae* predominate, are also listed.

More recently Molisch[9] has treated of the topic in some detail. He states that the capacity of leaves to develop roots is very widespread, but that leaves developing both roots and buds are not found in many plants. The leaves of the former category, therefore, cannot be utilised for propagation purposes. A few additional names are mentioned by the author.

The observations of Mr. Mullik are interesting in so much as the phenomenon had not hitherto been recorded for *Ficus religiosa*. One hopes that Mr. Mullik's observations will be successfully concluded and extended further by him and others, as one is really anxious to know the result of the work which was reported to be proceeding. It may turn out that these leaves are really incapable of producing shoots. Nevertheless, it would be interesting to know how long they could be kept artificially growing and what other peculiarities, if any, of behaviour they showed.

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[1] *Journ., Ind. Bot. Soc.*, 1930, ix, 65.

[2] *Ibid.*, 1931, x, 165. [3] *Ibid.*, 1931, x, 167.

[4] *Bot. Gaz.*, 1931, xci, 411. [5] *Bot. Gaz.*, 1933, xciv, 421.

[6] *Organography of Plants* Engl. Trans., 1900, i, 45ff.

[7] *Regeneration und Transplantation*, 1927, i. Berlin.

[8] *Natural History of Plants* Engl. Trans., ii, 40ff.

[9] *Pflanzenphysiologie als Theorie der Gartnerei*, 1930. Jena,

BENARES HINDU UNIVERSITY. N. K. TIWARY.
February 1, 1935.

PROCEEDINGS OF THE ANNUAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Society was held at the Prince of Wales' Museum on Wednesday the 3rd April, 1935, at 6-15 p.m. Rev. Father J. F. Caius, S.J., was in the Chair.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.
4. Such other business as may be properly brought before the meeting.

Mr. P. M. D. Sanderson, Honorary Secretary, announced the election of 47 new members since the last meeting. The total number of members for 1934 was 970 as compared with 954 in 1933, exclusive of Life Members of which we have 200. This membership includes His Excellency the Viceroy and Governors of every Province in India and Burma and Ceylon.

The Honorary Secretary then presented the Society's Annual Report for the year 1934. The Report gives a Survey of the Scientific activities of the Society.

BOMBAY NATURAL HISTORY SOCIETY.

OFFICE BEARERS—1935.

Patrons.—His Excellency The Viceroy of India; H. R. H. the Prince of Wales, K.G.

Vice-Patrons.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; H. H. The Maharaja of Jodhpur, K.C.S.I., K.C.V.O.; H. H. The Maharajah of Rewa, K.C.S.I.; H. H. The Maharaja of Bhavnagar; H. H. The Maharaja of Travancore; Mr. F. V. Evans, Liverpool; Sir David Ezra, KT., F.Z.S., Calcutta; Mr. A. S. Vernay, New York and London.

President.—H. E. The Right Hon'ble Lord Brabourne, G.C.I.E., M.C.

Vice-Presidents.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; The Hon'ble Mr. R. D. Bell, C.S.I., C.I.E., I.C.S.

Executive Committee.—Right Revd. R. D. Acland, Bishop of Bombay, Mr. Farrokh E. Bharucha, Major S. L. Bhatia, I.M.S., Rev. Fr. J. F. Caius, S.J., Mr. C. B. B. Clee, I.C.S., Mr. Alwyn Ezra, F.R.G.S., F.Z.S., Mr. J. B. Greaves, M.L.C., Mr. J. G. Ridland, Lt.-Col. S. S. Sokhey, I.M.S., Mr. A. Forrington (*Honorary Treasurer*), Mr. P. M. D. Sanderson, F.Z.S. (*Honorary Secretary*), Mr. H. M. McGusty, Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun. Mr. T. R. Bell, C.I.E., I.F.S. (Retd.), Karwar. Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor. Mr. C. H. Donald, F.Z.S., Dharmsala. Lt.-Col. F. C. Fraser, F.R.E.S., I.M.S. (Retd.), England. Dr. F. H. Gravely, D.SC., Madras. Mr. S. F. Hopwood, I.F.S., Rangoon. Mr. C. M. Inglis, M.B.O.U., F.Z.S., Darjeeling. Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore. Major E. G. Phythian Adams, F.Z.S., I.A. (Retd.), Nilgiris. Dr. Baini Prashad, D.SC., Calcutta. Mr. H. C. Smith, I.F.S., Maymyo. Lt.-Col. C. H. Stockley, O.B.E., D.S.O., M.C., Africa. Mr. J. H. Williams, Coimbatore.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY. FOR THE YEAR ENDING 31ST DECEMBER 1934.

ADMINISTRATION.

President.—H. E. The Right Hon'ble Lord Brabourne, G.C.I.E., M.C.

Vice-Presidents.—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; Rev. E. Blatter, S.J., Ph.D., F.L.S.; The Hon'ble Mr. R. D. Bell, C.S.I., C.I.E., I.C.S.

Executive Committee.—Right Revd. R. D. Acland, Bishop of Bombay, Mr. Farrokh E. Bharucha, Rev. Fr. J. F. Caius, S.J., Mr. Alwyn Ezra, F.R.G.S., F.Z.S., Mr. J. B. Greaves, M.L.C., Prof. V. N. Hate, B.SC., Mr. J. G. Ridland,

Lt.-Col. S. S. Sokhey, I.M.S., Mr. A. Forrington (*Honorary Treasurer*), Mr. P. M. D. Sanderson, F.Z.S., Sir Reginald Spence, Kt., M.L.C., F.Z.S. (*Joint Honorary Secretaries*), Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun. Mr. T. R. Bell, C.I.E., I.F.S. (Retd.), Karwar. Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor. Mr. C. H. Donald, F.Z.S., Dharmsala. Lt.-Col. F. C. Fraser, I.M.S., Coimbatore. Dr. F. H. Gravely, D.SC., Madras. Mr. S. F. Hopwood, I.F.S., Rangoon. Mr. C. M. Inglis, M.B.O.U., F.Z.S., Darjeeling. Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore. Major E. G. Phythian Adams, F.Z.S., I.A. (Retd.), Nilgiris. Dr. Baini Prashad, D.SC., Calcutta. Mr. H. C. Smith, I.F.S., Burma. Lt.-Col. C. H. Stockley, O.B.E., D.S.O., M.C., Meerut.

Staff.—S. H. Prater, M.L.C., J.P., C.M.Z.S. (*Curator*). C. McCann, F.L.S., V. S. LaPersonne (*Assistant Curators*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1934.

THE SOCIETY'S JOURNAL.

Three numbers of Volume XXXVII were published during the year under review.

Mammals.—Mr. Pocock concludes his paper on the Palm-Civets or Toddy Cats of the genus *Paradoxurus* and *Paguma*, inhabiting British India, begun in Volume XXXVI. For the Common Toddy Cat, described by Blanford under the name *Paradoxurus niger*, the author adopts Gray's specific name *hermaphroditus*, which recent Zoologists following Blanford's lead restricted to the Malayan Palm Civets. The Typical Palm Civet—*Paradoxurus h. hermaphroditus* is given as ranging southwards of the Narbada River through Southern India and Ceylon. 8 additional races distributed over Kashmir, Northern and Central India, Assam and Burma are described by the author. Among these are 3 new forms one of which *P. h. scindiae* is named after the late Maharaja Sir Madhowrao Scindia of Gwalior. His Highness was one of the first subscribers to the Mammal Fund which enabled the Society to carry out its extensive Mammal Survey from which so great a harvest of knowledge has accrued. In dealing with the Himalayan Palm Civets (*Paguma*) Mr. Pocock now recognises two species. *Paguma lanigera* from Tibet is based on a single known specimen believed originally to have come from the northern region of Nepal, but now known to have been obtained at Tingree in Tibet. The second species, the Himalayan Palm Civet *Paguma larvata* (*Paradoxurus grayi* of Blanford), ranges through the Western Himalayas, Nepal, Assam, Burma, the Shan States and the Andaman Island. Over this wide range the author recognises 7 different races.

Mr. McCann publishes an interesting note on the habits of the Flying Fox. The ground under the fruit trees where these bats have fed over night is generally covered with wholly or partially chewed fruit. These have wrongly been taken to be their droppings. From careful observation and examination of the stomach contents of specimens, the author was led to the conclusion that these bats live exclusively on the nectar, fruit juices and such fruits as liquefy easily in the mouth. No solids pass into the stomach of the bat. Here then is the basis of the legendary belief prevalent in many parts that the flying fox has no anus but passes its excreta from the mouth.

The various papers on Indian Mammals which have appeared in the Society's *Journal* and other kindred publications are a necessary preliminary to the long awaited and long overdue revision of Blanford's Volume on Mammalia in the *Fauna of British India* Series, which was sanctioned by the Secretary of State many years ago. It is confidently hoped that the authorities at the British Museum will make a special effort to expedite its publication. The greater part of the very large collections obtained by the Society during the Mammal Survey has been temporarily placed at the disposal of the British Museum for purposes of reference during the preparation of the new *Fauna*. There are however various institutions in India and abroad who contributed to the funds of the Survey on the understanding that they would receive a share of these collections in due course. The prolonged delay in the publication of the new edition has prevented the Society so far from discharging its obligation in this respect.

Birds.—Parts VII, VIII and IX of the Report of the Vernay Scientific

Survey of the Eastern Ghats (Ornithological) were published during the year. The Report provides a comprehensive list of the Birds of the Madras Presidency based on material obtained by the Survey and on past records.

In the report the authors deal *de novo* with the distribution and status of many species. The parts published during the year deal with the Pipits, Larks, Flower Peckers, Wood Peckers, Barbets and Cuckoos. Among the new subspecies described is a new race of the Golden-backed Woodpecker *Brachypternus b. tehminae*, which the authors have named as tribute to Mrs. Salim A. Ali, who accompanied and helped her husband Mr. Salim Ali on various Ornithological Surveys frequently under trying conditions.

The thanks of the Society are due both to Mr. Kinnear and Mr. Whistler, joint authors of the Report, which forms one of the most important contributions to Indian Ornithology made in recent years. It provides considerable amendments to and revisions of the distribution and status of species ascertained through the Survey subsequent to the publication of the *New Fauna.*

The Hyderabad Ornithological Survey.—Mr. Salim A. Ali concludes his Report on the Ornithological Survey of Hyderabad, Parts IV and V of which were published. Mr. Ali's Survey is confined mainly to the Eastern portions of the State. His plan to include the Northern and Western districts was unfortunately given up for want of funds. We hope that H. E. H. the Nizam's Government will make it possible for him in the near future to complete the Survey, which he has carried out so far with his usual efficiency and thoroughness.

Mr. Kingdon Ward's and Lord Cranbrook's Expedition to the Sources of the Irrawaddy River.—In 1930, Capt. Kingdon Ward and Lord Cranbrook made an expedition to the sources of the Irrawaddy River. While the object of the expedition was mainly Botanical, they collected some 152 birds, 340 mammals and a number of reptiles. In his paper on the 'Birds of the Adung Valley' Mr. N. B. Kinnear published a systematic list of the birds obtained on the expedition; while Lord Cranbrook gives an interesting narrative of the expedition. The collection of Birds includes two new races, but its main interest lies in the considerable addition made to our knowledge of the distributions of a number of species, which were believed to be confined mainly to the Himalayas and which were hitherto unknown to occur in Burma.

Mr. H. St. J. Philby's Journey through the 'Empty Quarter' in Arabia.—Mr. Philby, the noted traveller and Arabian explorer, describes his journey through the Rub al Khali in his fascinating book the *Empty Quarter.* In spite of innumerable difficulties he collected a number of birds, which were subsequently presented to the British Museum by H. M. King Abdul Aziz. Mr. Philby's collection and the notes made by him formed the basis of a paper by Mr. N. B. Kinnear published in Volume XXXVII, No. 3. The paper helps to reveal the species which inhabit this desolate and hitherto unknown region. The thanks of the Society are due to Mr. Kinnear for this interesting paper. His continued association with the work of the Society for which he did so much is greatly appreciated.

Mr. Stuart Baker contributed a description of the Long-tailed Duck *Clangula hyemalis*, an interesting addition to the Indian avifauna. A male of this duck changing from eclipse into winter plumage was shot by Capt. A. E. Dredge at Chaman, British Baluchistan, on the 18th October, 1933.

A feature of the Ornithological contributions to the *Journal* is the numerous faunistic lists recording the bird life of various towns and districts or provinces in the Indian Empire or the countries which adjoin it. During the year the following lists were published:—Birds of Ghazipur by Rev. F. S. Briggs; Birds of Fort Munro, Sulaiman Hills, by Mr. H. W. Waite. Mr. Higgins completed his interesting account of the Game Birds and animals of Manipur.

Fishes.—Mr. Mukerji completes his Report on the collection of fishes made by Col. R. W. Burton in the Myitkyina District, Upper Burma.

Dr. Hora of Zoological Survey of India contributes an interesting paper on the 'Wanderings of the Bombay Duck (*Harpodon nehereus*)'. From the economic standpoint, this is one of the most important food fishes of the Bombay Coast. At the present time, we know little of the factors which govern the mass movement of these fishes, which appear in abundance on the Bombay Coast during the monsoon and are comparatively scarce at the other seasons. From the meagre data available the author discusses the various factors which may be responsible for the mass movements of 'Bombay Duck'. He indicates that the problem requires more detailed investigation. At present we know nothing about the factors which control the periodic migration of any of our important food fishes. It is clear that investigation on these lines would be of considerable advantage to the industry and would afford data for placing the exploitation of our waters on a sounder and more scientific basis.

We also published Mr. Hamid Khan's paper on the 'Habits and Habitats of the Food Fishes of the Punjab'.

Insects.—In Volume XXXVI Mr. Martin E. Mosely began his series of articles on the 'Indian Caddis-Flies'—which when completed will form a standard work on *Indian Trichoptera.* Part II of the serial, dealing with the classification of these insects, was published during the year.

There is a paper on 'Indo-Ceylonese Chalcid Flies' by Mr. T. V. Ramakrishna Ayyar and V. Margabandhu. It is a continuation of the previous lists published by the senior author. The paper serves to bring up to date our records of the Indo-Ceylonese forms. In view of the economic importance of these minute wasp-like creatures as natural enemies of important crop pests, the data provided will be of some value to those agricultural entomologists interested in the biological control of insect pests by insect parasites.

Another paper dealing with Economic Entomology is by Mr. C. Cherian on 'South India Syrphids'. Commonly known as 'Hover flies', the Syrphids play an important part in checking one of the worst insect pests of cultivated crops viz. the *aphids.* Mr. Cherian also publishes a further note on *Argyria fuscivenalis,* a Pyralid caterpillar pest of the *Crataeva religiosa,* an ornamental tree common in gardens together with measures for its control. The paper gives information on the distribution of species, hosts, etc., of the South Indian forms. Mr. V. Margabandhu contributes an Annotated List of Indo-Ceylonese Termites. The available literature dealing with the various species is recorded, together with notes on habits, distribution, etc.

Botany.—Parts XXIII, XXIV and XXV of the Revision of the Flora of the Bombay Presidency by the late Revd. E. Blatter were published during the year.

The death of Father Blatter in May 1934 has removed a great figure from the Indian Botanical World, and a valued counsellor and friend of the Society with which he was associated since 1904. An obituary notice and a list of his numerous scientific contributions to Asiatic Botany were published in Volume XXXVII, No. 2.

The Flora of Waziristan by E. Blatter and J. Fernandez was completed. Certain orders have been omitted from these papers, which were published in 5 parts. They are being worked out by a specialist and will be published later.

Popular Articles.—Mr. Stuart Baker continues his serial on 'Waders and Semi-Sporting Birds' which is intended to supplement his previous Volumes on Indian Game Birds. Three Volumes of this series have been so far published by the Society—the fourth volume will deal with the Partridges and Quails, and the fifth with the Wading Birds.

Parts XIV, XV and XVI of 'Some Beautiful Indian Trees' by Father Blatter and Mr. W. S. Millard are issued. 24 of our more conspicuous and ornamental trees have now been illustrated in colour and described. It is intended to complete the series with descriptions of 6 others, making 30 in all. Additional plates have been printed to enable the Society to issue the serial in book form.

By courtesy of the *Field* we were able to reproduce Mr. E. H. Peacock's articles on 'Tsaing and Bison in Burma'. They are illustrated with photographs taken from life by the author. Equally interesting are the reminiscences of that veteran sportsman Mr. Thom, whose articles on 'Bison and Tiger Shooting' were published during the year.

The Editors of the *Journal* once more make an appeal to members to send in accounts of sport and travel in India, and take this opportunity of thanking all those who have contributed notes and articles during the year. As usual the section of the *Journal* containing the Miscellaneous Notes has been full of interest. It is a feature which we would like to develop further.

Wild Animals of the Indian Empire and the Problem of their Protection.—Part II of the series of articles on 'the Wild Animals of the Indian Empire' dealt with Deer and Antelope. Part III on the Carnivores is now ready for publication. Further issues will deal with the Primates and the Rodents. The cost of the numerous coloured and black and white plates issued with these articles has been met by Mr. F. V. Evans. The Committee of the Society once again would like to place on record their thanks and appreciation of the assistance received from Mr. F. V. Evans during the year. The purpose of these articles is to provide a well illustrated popular handbook of the animals of the Indian Empire with a view to educating public opinion and creating a wider interest in the preservation of wild life. To give wider publicity to the question, the articles are being issued separately in pamphlet form. A large number of copies have been distributed to various agencies and individuals and the publication has received wide attention both in the English and vernacular papers. Accompanying Part II of this serial are contributions by Mr. Milroy, Conservator of Forests, Assam, and Mr. F. W. Champion, Deputy Conservator of Forests, United Provinces, on the problem of protecting wild life in their respective provinces. Our thanks are due to both the gentlemen for their valuable contributions. An interesting development of the whole question of Preservation of Wild Life in India was the recent Inter-Provincial Conference convened by the Government of India at Delhi in January 1935 at which the Society was represented by the Curator, Mr. S. H. Prater.

The Conference was instrumental in making a number of detailed recommendations for the better protection of wild animals both inside and outside forest areas. If these recommendations are accepted and put into force by the various provincial governments, much will have been accomplished to improve the deplorable conditions which exist in many parts of the country. But while the Conference made numerous recommendations of detail—the broad issues underlying the whole problem remain unsettled. Among these is the need of fully exploring the possibility of creating permanent sanctuaries wherever necessary for giving permanent shelter to wild life. Equally important is the question of creating a definite agency within the forest department for administering the laws relative to the protection of wild animals. To fix the responsibility on an already overworked and under-staffed department without providing it with adequate means to enforce these laws will not improve the position. The same holds good regarding the protection of animal life outside forest areas, where their destruction is now greatest. Mere legislation without the means to enforce it, must remain, as at present, quite useless in preventing the destruction of wild life outside forest areas both in and out of season.

Publications.—The Jubilee Number of the Society was issued free during the year to members. The thanks of all members are due to Mr. A. S. Vernay, Vice-Patron of the Society, who contributed Rs. 1,500 towards its cost. The book gives an account of the history and the work of the Society during the past 50 years. Started by 8 residents of Bombay, the Society has exerted an influence and carried out a work which has reached far beyond this city and which has left its impression on the annals of scientific progress in India. All honour to those who laboured in the building up of it. The fine Natural History Museum in Bombay, the many volumes of the Society's *Journal*—and its numerous publications are a lasting testimony to the interest and devotion of its members in all parts of the Indian Empire and in countries abroad.

The Museum.—The new wing of the Prince of Wales' Museum to which the Natural History Section is to be transferred is nearing completion. The interior architecture has been specially designed to meet the requirements of a modern Natural History Museum. Special attention has been paid to the lighting of the galleries. The new building gives the Society a unique opportunity of developing the Natural History Section, and placing the whole standard of exhibition on a modern basis. Designs for the internal arrangement of the galleries are being prepared by Mr. Prater and his staff. An attempt is being made to provide the maximum amount of floor space for the free movement of visitors. The show cases are built into or along the walls of the gallery. Provision is made for a series of large diorama groups exhibiting various species of animals, birds, reptiles and fishes in their natural environment, on the lines of the groups exhibited in the Natural History Museums at New York and at Berlin. An attempt is also being made to introduce a harmonious colour scheme for show cases, walls and flooring in each gallery which will be attractive and pleasing, and new effective methods of labelling are being introduced.

ACCOUNTS.

Revenue Account.—This shows a loss of Rs. 4,847-8-9, which is the loss shown on the Balance Sheet. It is a considerable loss, and if there were no other factors to be taken into account, the position of the Society would be serious.

Publication account.—The method adopted by the Society with regard to its publication is to debit the whole cost of a publication to Publication Account and to credit against that the whole of the sale proceeds of that publication, until such time as that publication stands at no value in the Publication Account. During the year under review, the Society has received Rs. 3,428-6-11 by sale of publications and this sum has been utilised in this manner to write down the value of the Society's stock of publication. The Publication Account is by this means kept in a very healthy position and in future years, the Society can look forward to a reasonable income from this Account from sale of publications which have been written down to nil in this manner.

For example, in the revenue account, it will be noticed that an item of Rs. 711 appears for sales of Game Books, Vols. I and II. The Society has a considerable stock of Game Books, Vols. I and II, the whole cost of which has been written off in previous years. The sale proceeds from these books now appear as net profit.

Balance Sheet.—Investments are shown as per last balance sheet or market value, whichever is lower, and considerable capital appreciation is hidden in this manner. The Society has, since the Balance Sheet was made up, disposed of its holdings of 3½ per cent Government Paper to the face value of Rs. 38,000, and has realised from this sale Rs. 36,695-15-8 or Rs. 7,549-11-8 more than the value shown in the present Balance Sheet. This appreciation alone more than counterbalances the loss for the year 1934.

Life Membership Fees.—In 1933 the Society received Rs. 1,950 on account of Life Membership Fees, and this item was in that year taken into Revenue account, as it was felt that the reserve shown in the Balance Sheet on account of Life Membership fees had reached an adequate figure. This year only one Life Membership fee has been received—Rs. 350, and this sum has not been taken into general revenue account, but has been used to increase the Society's reserve for Life Membership Fees.

This now stands at Rs. 47,500. Under rule 7 of the Memorandum of Association of the Society, Life Members' subscription may be taken into revenue provided the total investments of the Society are in excess of the toal of Life Membership subscriptions. The market value of our investments exceeds this figure considerably.

COMPARISON OF REVENUE AND EXPENDITURE WITH THE PREVIOUS YEAR.

Revenue	1933	1934	Expenditure	1933	1934
Subscriptions ...	23,467 ...	22,810	Salaries ...	19,060 ...	19,652
Entrance Fees ...	1,070 ...	820	Prov. Fund	1,539 ...	1,556
Sale of Journals.	2,093 ...	1,605	Rent ...	2,436 ...	2,436
Interest ...	3,507 ...	3,580	Journals ...	10,595 ...	8,679
Sundries ...	3,897 ...	1,198	Sundries ...	2,856 ...	2,537
Loss	2,452 ...	4,847			
Total Rs. ...	36,486	34,860	Rs. ...	36,486	34,860

General.—The loss on the year's working was Rs. 4,847-8-9 as compared with Rs. 2,452-8-9 the previous year. Expenses have been cut down as much as possible, the *Journal* reduced in cost and the staff is still working on a cut rate of pay. The financial position is sound, but we cannot continue to work at a loss. Our revenue depends almost entirely on the membership, and considering the acute economic depression during the last 2 or 3 years this has been maintained fairly well. So far as the present year is concerned the appreciation in securities was fortuitous. It is hoped conditions will be better now and that our membership will be increased, otherwise there is no alternative but to cut expenditure to meet our revenue. But this cannot be done without the risk of impairing the efficiency of the staff and the value of the *Journal*, which is the main attraction to members and the cost of which has already been considerably reduced.

P. M. D. SANDERSON,
Honorary Secretary.

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1934.

LIABILITIES	Rs A P	Rs A P
Life Membership fees :	......	47,500 0 0
Donations for specific objects unexpended :		
Show Cases, etc. in existing building A...	2,402 7 4	
Show Cases in new building B.	17,784 9 0	
Jubilee Number Fund	957 13 0	
Journal Fund	6,282 14 0	
Vernay-Hopwood Chindwin Expedition ...	518 6 9	27,946 2 1
Sundry Creditors :		
Printers of Journal	2,782 5 10	
For Expenses	250 0 0	3,032 5 10
Surplus Assets :		
Balance as per last Balance Sheet ...	34,856 5 11	
Less—Loss on Revenue Account... ...	4,847 8 9	30,008 13 2
Total ...		1,08,487 5 1

ASSETS	Rs A P	Rs A P
Investments as per last Balance Sheet or market value on 31st December 1934, whichever is lower :		
Rs. 28,000 Govt. 3½% Pro. Notes at Rs. 74-9/16%...	20,877 8 0	
,, 10,000 ,, do. do. 82-11/16%.	8,268 12 0	
,, 15,000 ,, 5% 1945-55 Loan at par....	15,000 0 0	
,, 8,000 ,, 6½% Dev. Loan ,, ...	8,000 0 0	
,, 14,000 Port Trust 4% Bond at 77% ...	10,780 0 0	
,, 15,000 Imp. ,, 4% ,, at 76% ...	11,400 0 0	74,326 4 0
Investments on account of Show Cases in New Building :		
Fixed Deposit with Eastern Bank, Ltd., Bombay...	10,300 0 0	
Rs. 5,700 Govt. 5½% Loan 1938-40 at par...	5,700 0 0	
,, 500 ,, 5 % ,, 1945-55 ,, ...	500 0 0	16,500 0 0
Cash—		
With National Bank of India Ltd., Bombay	5,361 0 11	
With National Bank of India Ltd., London, £30-17 at 1/6	411 5 4	
On hand	150 0 0	5,922 6 3
Sundry Debtors :	...	1,716 4 0
Furniture :		
Balance as per last Balance Sheet	1,677 0 0	
Additions during the year	25 0 0	
	1,702 0 0	
Less Depreciation	50 0 0	1,652 0 0
Loan to Staff:	...	413 0 0
Publications, excluding Journals: As certified by the Hon. Secretary ...	...	300 0 0
Game Books, Vol. III: Stock on hand as certified by the Secretary	...	1,011 9 0
Bird Charts, Stock on hand as certified by the Secretary	...	3,691 14 3
Bates' Bird Life : Stock on hand as certified by the Secretary	...	1,106 0 6
Butterfly Books : Stock on hand as certified by the Secretary	...	333 8 10
Beautiful Indian Trees : Stock on hand as certified by the Secretary	...	1,514 6 3
Total ...	...	1,08,487 5 1

Note.—A stock of 20,400 old Journals and the Valuable Research Collection and Library of 2,550 Volumes have not been taken into account on the Asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the cash book and from the information given to us, and have verified the investments.

In our opinion, such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and explanations given to us.

BOMBAY, *27th February, 1935.*

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) A. FORRINGTON,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1934.

	Rs A P	Rs A P		Rs A P	Rs A P
To Salaries ...	19,652 0 6		By Subscriptions ...	22,810 7 2	
,, Society's Contribution to Staff Provident Fund ...	1,556 8 0		,, Entrance Fees ...	820 0 0	
,, General charges ...	373 7 8		,, Sales of Journals ...	1,605 9 8	
,, Rent ...	2,436 0 0		,, Interest on Investments ...	3,580 14 2	
,, Stationery and Printing ...	242 4 6		,, Taxidermy Department ...	56 5 0	
,, Postage ...	1,125 10 9		,, Sales of Game Books, Vols. I & II ...	711 0 11	
,, Library ...	395 4 9		,, Society's small Publications ...	428 8 0	30,012 12 11
,, Audit Fee ...	250 0 0		,, Balance of Expenditure over Income ...		4,847 8 9
,, Insurance ...	100 0 0				
,, Furniture Depreciation ...	50 0 0				
,, Cost of Printing Journals ...	8,679 1 6	34,860 5 8			
Total ...		34,860 5 8	Total ...		34,860 5 8

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1934.

	Rs A P	Rs A P		Rs A P	Rs A P
To Stock of Bird Charts and Albums ...	5,962 9 7		By Sales of Bird Charts and Albums ...	3,002 0 10	
,, Expenses during the year ...	731 5 6	6,693 15 1	,, Stock on hand ...	3,691 14 3	6,693 15 1
,, Stock of Game Books, Vol. III ...	1,098 3 8		,, Sales of Game Books, Vol. III ...	165 0 0	
,, Expenses during the year ...	78 5 4	1,176 9 0	,, Stock on hand ...	1,011 9 0	1,176 9 0
,, Stock of Bates' Bird Life ...	....	1,197 6 6	,, Sales of Bates' Bird Life ...	91 6 0	
			,, Stock on hand ...	1,106 0 6	1,197 6 6
,, Stock of Butterfly Books ...	496 2 10		,, Sales of Butterfly Books ...	170 0 0	
,, Expenses during the year ...	7 6 0	503 8 10	,, Stock on hand ...	333 8 10	503 8 10
,, Stock of Beautiful Indian Trees ...	....	1,514 6 3	,, Beautiful Indian Trees ...	....	1,514 0 3

BOMBAY NATURAL HISTORY SOCIETY.

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1934.

	Rs a p	*Rs a p*		*Rs a p*	*Rs a p*
To Expenditure on Show Cases, etc. ...	1,527 6 0		By Unexpended Balance for Show Cases, as per last Balance Sheet ...	2,133 11 4	
,, Balance carried to Balance Sheet ...	2,402 7 4	3,929 13 4	,, Donations for the Modeller's Salary etc.	1,796 2 0	3,929 13 4
,, Balance Carried to Balance Sheet ...		17,784 0 0	,, Unexpended balance for Show Cases in New Building as per last Balance Sheet	17 ,147 2 4	
			,, Interest on Building Investments ...	637 6 8	17,784 9 0
,, Expenses on Printing Plates, etc. ...	542 3 0		,, Jubilee Fund		1,500 0 0
,, Balance carried to Balance Sheet ...	957 13 0	1,500 0 0			
,, Expenditure on Printing Plates for Journal	4,127 11 0		,, Balance as per last Balance Sheet in Special Journal Fund...	7,533 7 0	
,, Balance carried to Balance Sheet ...	6,282 14 0	10,410 9 0	,, Donations received during the year ...	2,877 2 0	10,410 9 0
,, Expenditure during the year	1,467 12 6		,, Vernay-Hopwood Chindwin Expedition		1,986 3 3
,, Balance carried to Balance Sheet ...	518 6 9	1,986 3 3			

BOMBAY, *27th February, 1935.*

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.
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(Sd.) A. FORRINGTON,
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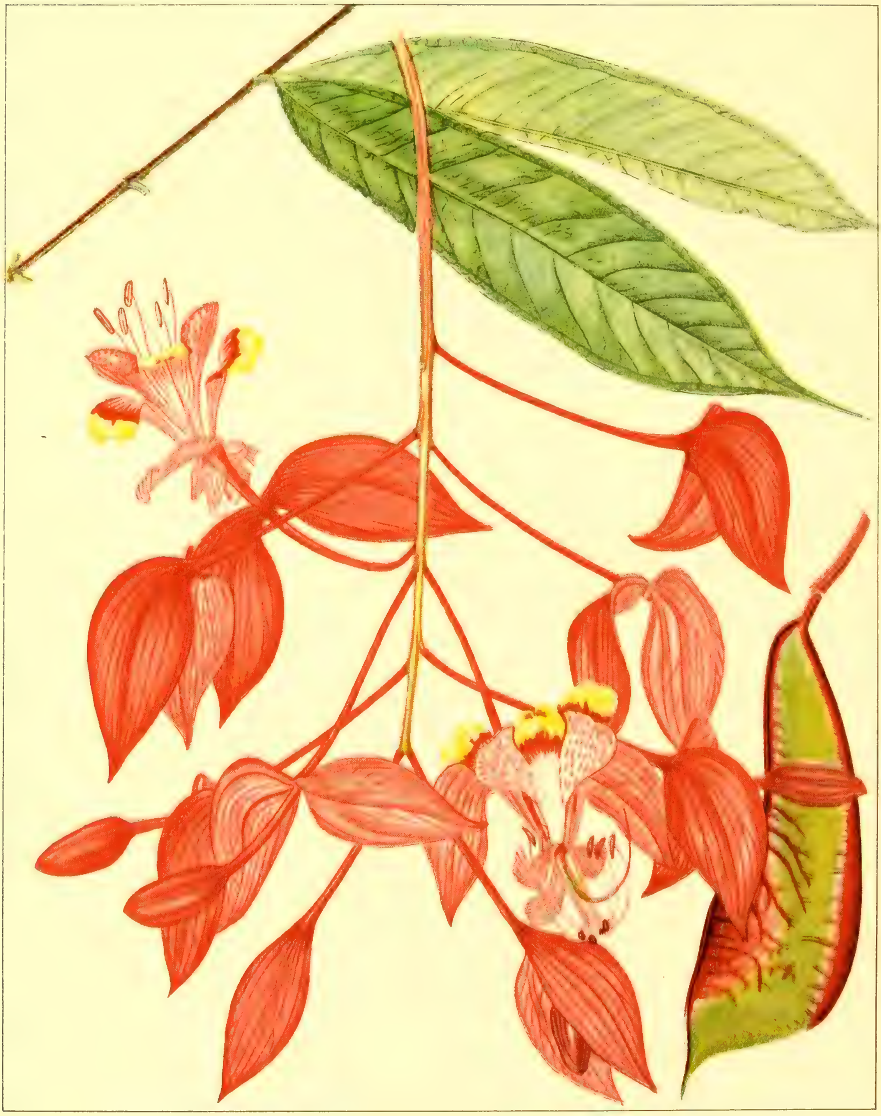

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THE NOBLE AMHERSTIA
Amherstia nobilis, Wall.

JOURNAL
OF THE
Bombay Natural History Society.

DECEMBER, 1935. VOL. XXXVIII. NO. 2.

SOME BEAUTIFUL INDIAN TREES.

BY

THE LATE E. BLATTER, S.J., Ph.D., F.L.S.,

and W. S. MILLARD, F.Z.S.

PART XIX.

(*With two coloured plates, one black-and-white plate and two text-figures*).

(*Continued from page* 94 *of volume* xxxviii).

THE NOBLE AMHERSTIA.

Popular names: *Thawka*, Burm.

Amherstia nobilis Wall. Belongs to the family *Leguminosæ*. The name *Amherstia* is in honour of Countess Amherst and her daughter, Lady Amherst, promoters of Indian botany: *nobilis*, on account of the exquisite beauty of the flowers.

Description: A moderate-sized tree 30-40 ft. high, much like the Asoka (*Saraca indica*) in general appearance, when not in bloom. The stout trunk is covered with thick, uneven, dark, ashy-grey bark. The spreading branches are overlaid with dense dark-green foliage. The young shoots and leaves are pendulous and downy. The leaves, 1-1½ ft. long, are composed of 6-8 pairs of opposite leaflets. The leaflets 6-12 in. long by 1-1½ in. wide are distantly arranged; in shape oblong with almost parallel sides, narrowing slightly to the base and suddenly tapering off to a fine point at the apex. They are smooth and dark green above, paler and softly hairy below. At the base of the leaf-stalk there are two leaf-like lance-shaped and sharply pointed stipules, 1-1½ in. long, which fall off soon after the leaf develops.

The flowers are arranged in very large candelabra-like racemes which arise from the axils of the leaves, and frequently attain 3 ft. in length. The reddish branches of the racemes support from 20 to 26 beautiful flowers. The individual flower stalks together with the large leaf-like bracts below the calyx are intensely red. The calyx is composed of 4 sepals united into a tube and a little shorter than the bracts. The flower is composed of 5 conspicuous petals. The large standard is 3 in. long by 2 in. at its widest part, reversedly heart-shaped with rounded lobes and toothed margins. In colour it is red with a splash of white between the lobes and a roundish yellow spot in the centre. The wing petals are like the standard but much narrower, spreading and reflexed. The two keel petals are small. The stamens are disposed in two sets, one composed of 9, the other solitary. The anthers are large and dark-green in colour. Ovary flat and densely hairy. The fruit is a broad pod.

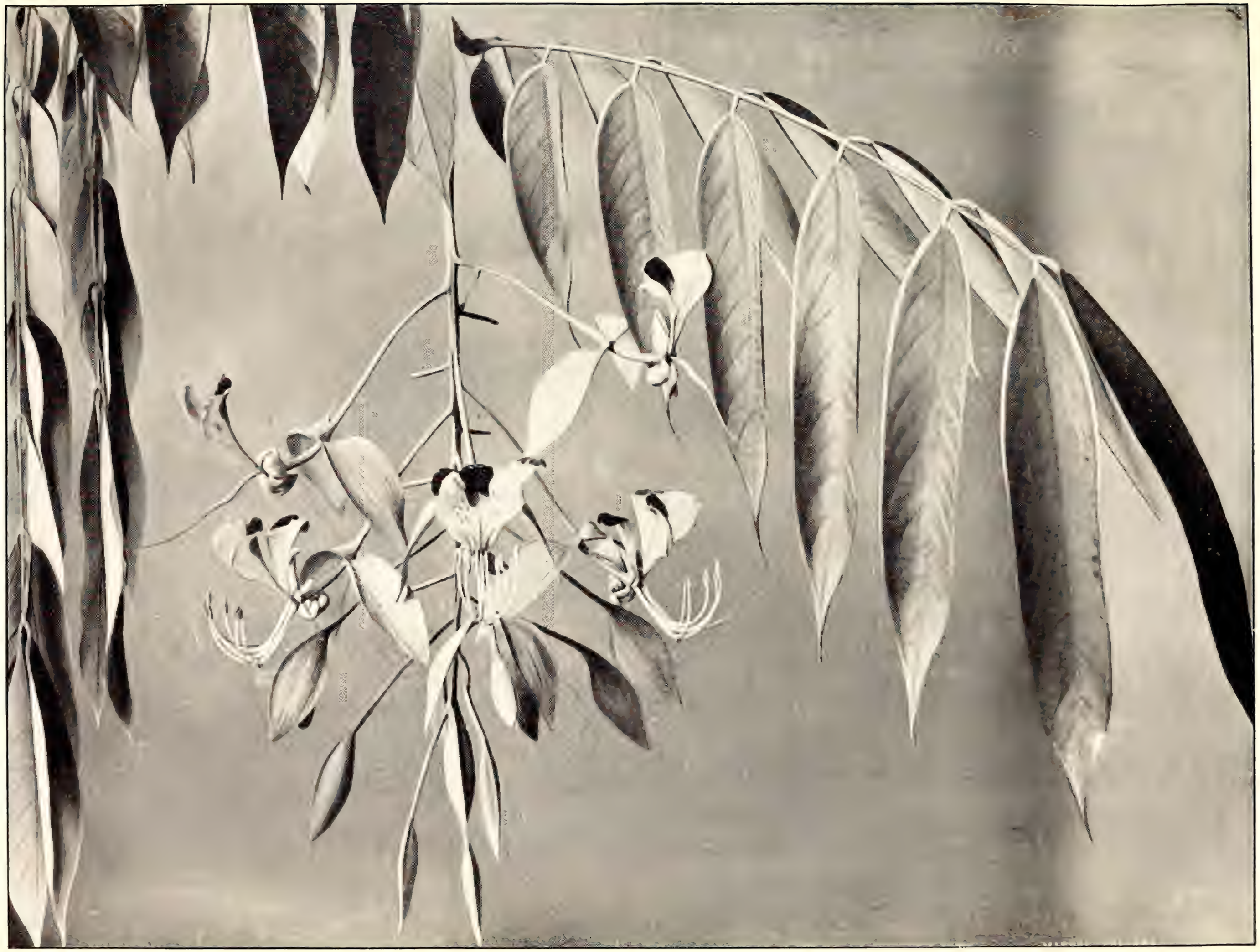
Flowers: It flowers during the greater part of the year, but chiefly from January to March (Troup).

Distribution: Indigenous in Tenasserim, Burma (Troup).

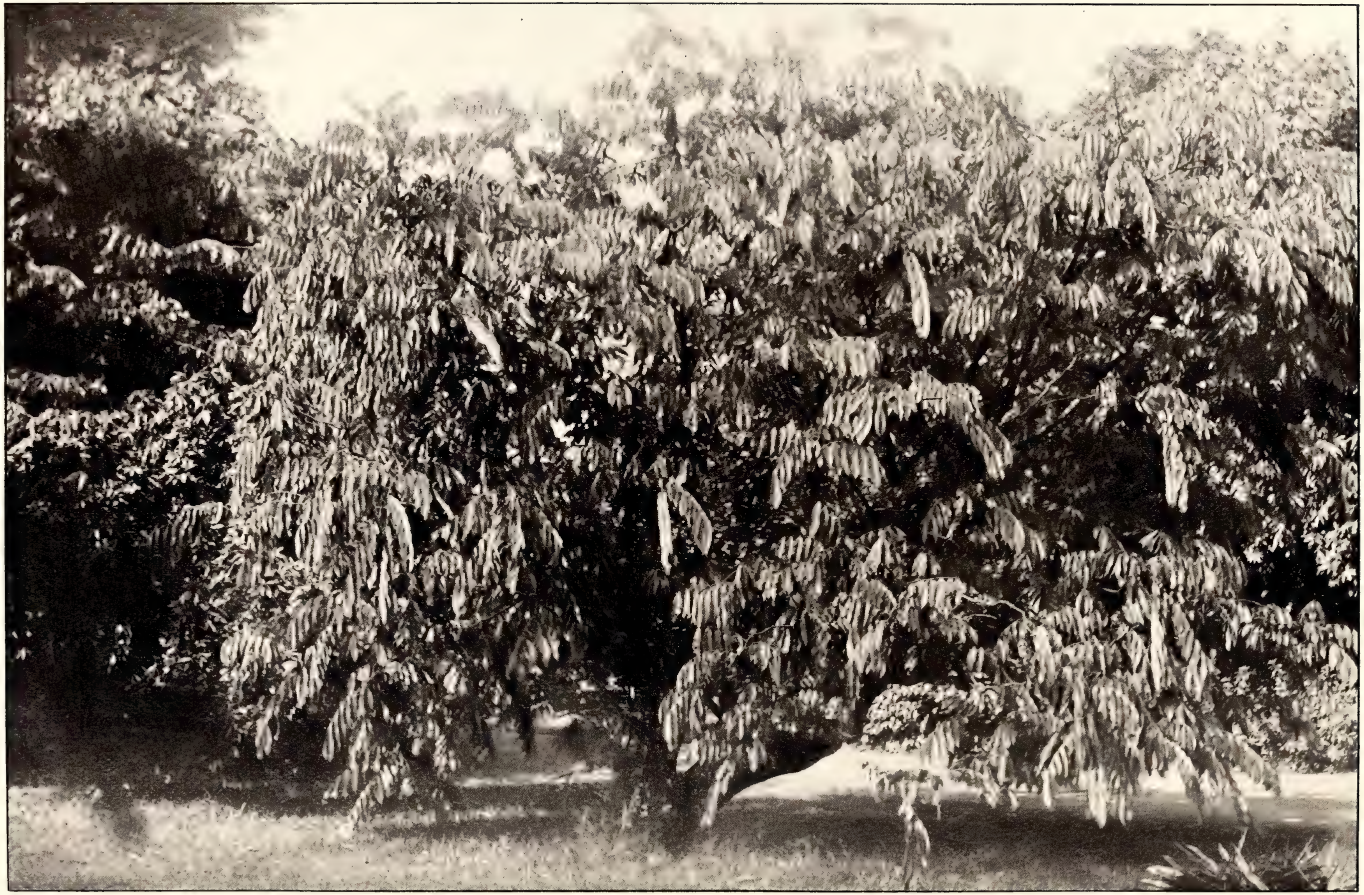
Uses: Cultivated as an ornamental tree in the moister parts of Burma and Southern India.

Gardening: The tree is somewhat difficult to cultivate, being delicate when young and requiring a rich soil and a warm moist equable climate. It may be raised from seed in pots or baskets, but can best be propagated by layering in the hot season and planting out during the rains. It is successfully cultivated in Ceylon, but seldom ripens its seeds there (Troup).

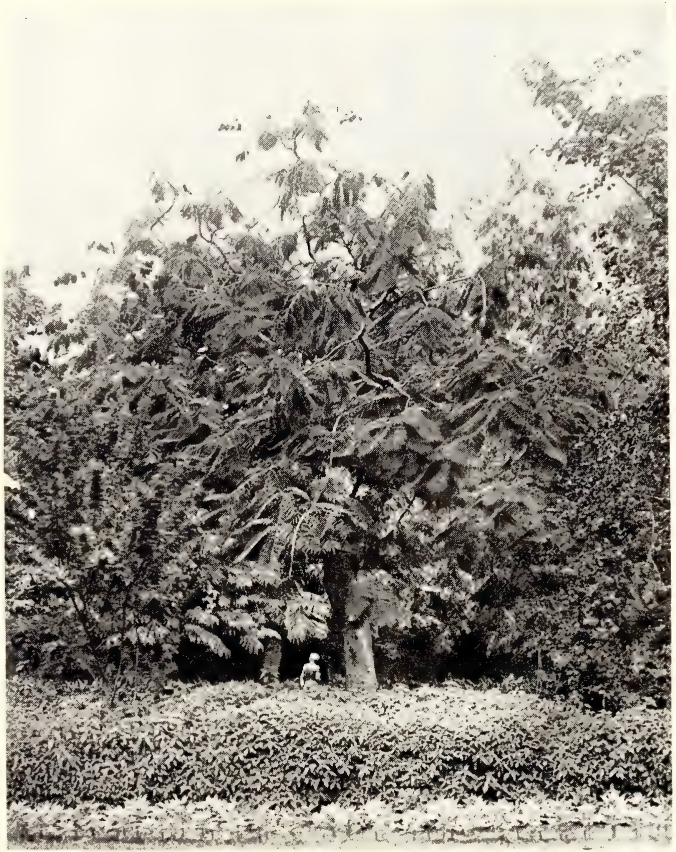
This is perhaps the most beautiful of all flowering trees. The large graceful sprays of vermilion and yellow flowers drooping from every branch, set in the deep green foliage present an aspect of astonishing loveliness, scarcely equalled by any tree in the world. Very remarkable and striking are the long hanging rich red or purplish clusters in which the young leaves appear.

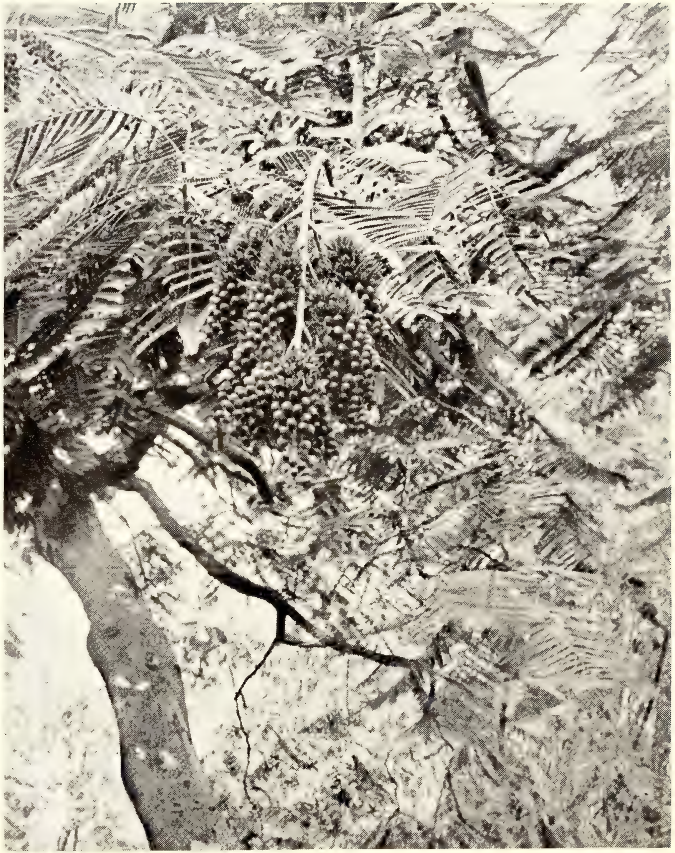


A flowering spray of *Amherstia nobilis.*



The Noble Amherstia Tree
(*Amherstia nobilis*).

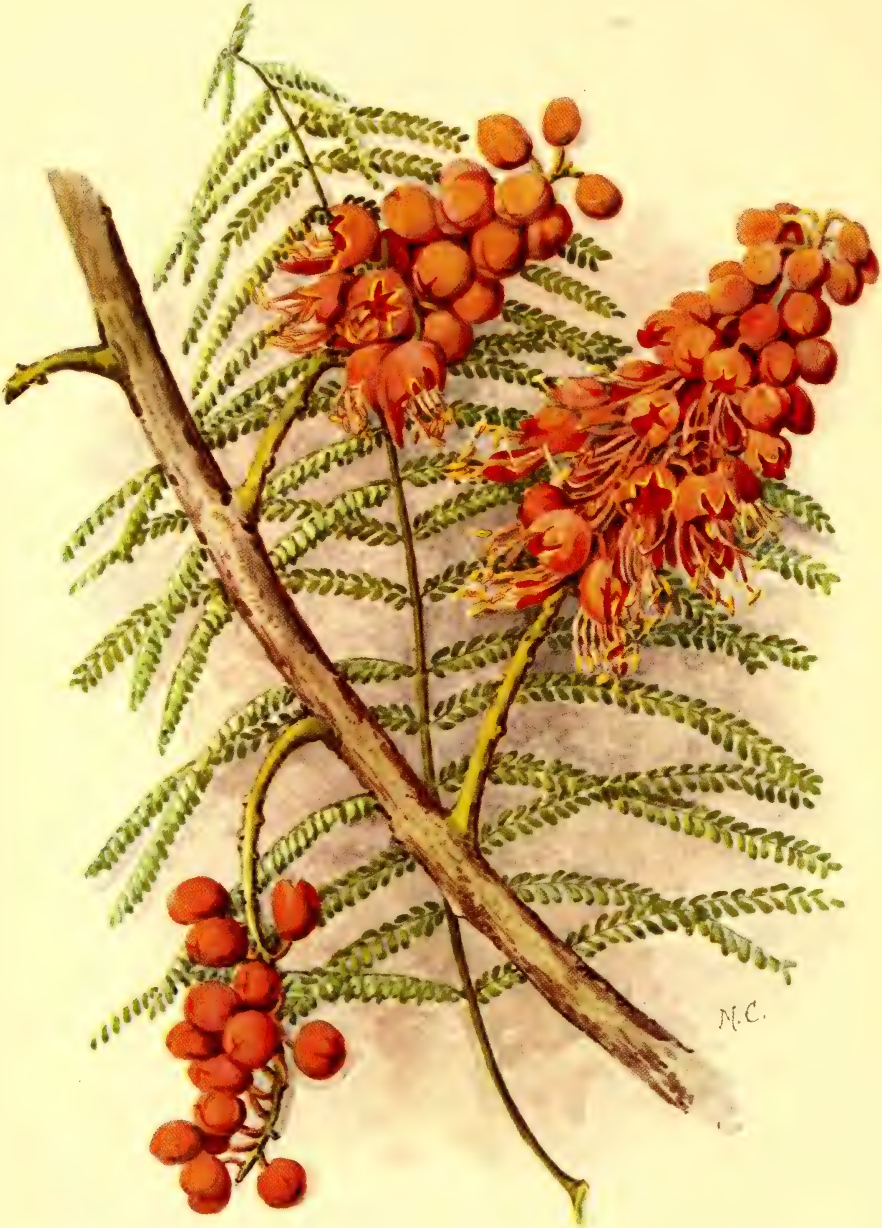




Photos by C. McCann.

Colville's Glory (*Colvillea racemosa*, Bojer).

Flowers of Colville's Glory (*Colviliea racemosa*, Bojer).



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COLVILLE'S GLORY
Colvillea racemosa, Bojer.
(about ⅓ nat. size)

COLVILLE'S GLORY.

Colvillea racemosa Bojer. Belongs to the family *Leguminosae.* The name *Colvillea* is in honour of Sir Charles Colville, Governor of Mauritius; *racemosa* on account of the flowers being arranged in racemes.

Description: A moderate-sized tree 40-50 ft. high with spreading branches. In general form and from the character of its foliage it might be easily mistaken for the Gul Mohur. The leaves of the two trees are very similar. In the present species, the leaf is composed of from 20-30 pinnæ or minor leaves—a Gul Mohur leaf has only 11-18. The pinnæ bear 20-28 pairs of small elliptical leaflets arranged opposite each other. In the Gul Mohur these leaflets are more oblong.

The flowers are very curious and striking. In the bud they are almost nut-like in form and appear in large drooping clusters, the buds diminishing in size as they approach the end of the raceme. The sepals are more or less obliquely shaped in outline and sharply pointed. Externally they are silky to the touch. Their colour ranges from bright orange to red. Internally they are smooth and creamy. The standard petal of the flower is the smallest and not the largest as is usual. It is orange red, and is flanked by two very long narrow erect wing petals, deep red in colour. Opposite the standard petal is the rudimentary boat-shaped keel petal. The 10 stamens are free, 3 of them are inserted below the standard, 2 under the wing petals, 1 under the keel, and 4 under the ovary. The anthers are yellow. The clumps of bright coloured flowers among the feathery grey green foliage give the tree a very striking appearance. The pod is 2-valved and round.

Flowers: In India the tree flowers in July and August but in Madagascar it flowers in April or May.

Distribution: It is supposed to be a native of East Africa, but it was discovered by Bojer, in 1824, on the West Coast of Madagascar, where a single tree was cultivated by the natives. It is the only species of the genus.

Gardening: It is suited to moist or moderately dry low country, and is only propagated from seed. Though it is well worthy of cultivation for its beautiful flowers and foliage, it is seldom seen outside botanical gardens and flower fanciers' collections.

(*To be continued*).

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS.

(Ornithological Section).

BY

HUGH WHISTLER, M.B.O.U., assisted by N. B. KINNEAR, M.B.O.U.

PART XII.

(*Continued from page* 764 *of volume* xxxvii).

Tyto alba stertens Hartert.

Tyto alba stertens Hartert, Nov. Zool., vol. xxxv (1929), 98—Cachar.

Not met by the Survey. The Barn Owl is probably more common and generally distributed than the few records imply. Dewar says it occurs at Madras, and two males from Madras dated March 1877 are in the Hume Collection.

The Hume Collection also contains two undated birds from Calicut. William Davison says that it is rare on the Nilgiris where it lives in holes in rocks. In Travancore, on the other hand, Ferguson says that it is found occasionally in the low country about human habitations. He gives the breeding season as December and January.

I have only seen one specimen from Java and this certainly seemed to be a little more brightly coloured than Indian birds. No Ceylon birds examined.

Tyto longimembris longimembris (Jerdon).

Strix longimembris Jerdon, Madras Jour. Lit. Sci., vol. x (1839), p. 86—Neilgherries.

Very little is known about the distribution of the Grass-Owl in the Presidency, and it was not met by the Survey. On the western side it was procured by William Davison in the Brahmagherries, a male and female dated respectively 19 April 1881 and 14 February 1882 being in the British Museum. In the Nilgiris it was first procured by Jerdon on the grassy side of a hill at 6,000 ft. near Coonoor and the specimen marked 'Madras, Jerdon' in the British Museum is probably this bird, the type. William Davison tells us that he shot it himself on the Nilgiris on several occasions and handled two or three others, so it is probably an uncommon resident in these hills.

Terry was under the impression that an owl flushed from long grass on the hillside at Pulungi in the Palnis was probably of this species.

On the eastern side of the Presidency we have only Jerdon's statement that he had procured the Grass-Owl in the Nellore District, twice, once in long grass when he was hunting florican and once in long reeds in the dry bed of a tank at Yeroor.

Nothing is known about the breeding season in the Presidency. All Indian birds clearly belong to the one race.

Asio flammeus flammeus (Pontoppidan).

Strix flammea Pontoppidan, Danske Atlas, vol. i (1763), p. 617, pl. xxv—Denmark.

The Short-eared Owl was not procured by the Survey, but it is known to be an irregular winter visitor to the Presidency. On the eastern side it is only recorded from the neighbourhood of Madras. Here it was recorded by

Dewar as being fairly common and Mr. A. S. Thyagaraju (*J.B.N.H.S.*, xxxvi, 752) has some very interesting notes on its occurrence there in large numbers from about the end of November 1923 to the end of January 1924. He did not however notice it in other years.

On the western side we have very little information. Hume states (*S.F.*, x, 343) that it certainly occurs on the lower slopes of the Nilgiris and this is confirmed by the fact that Col. H. R. Baker shot the female of a pair in a grassy swamp at Ootacamund on 31st December 1921 (*Birds of South India*, p. 208). This specimen is now in my collection. Kinloch says that it is 'very rare indeed' in the Nelliampathies, and Hume (*loc. cit.*) says that it occurs in the Palnis.

In Travancore there is one definite record (*S.F.*, iv, 372) when Bourdillon shot a female hawking at midday in bright sunshine at 4,000 ft. in the end of December. This presumably refers to the specimen in the British Museum collected by Bourdillon on 28 December 1875 in the Colathoorpolay Valley 3,000 ft., according to its label. Elwes, however, lists it for the Cardamum Hills (*Ibis* 1870, p. 527).

In some years the Short-eared Owl visits Ceylon in the months from November to February.

Strix indranee indranee Sykes.

Strix indranee Sykes, P.Z.S. 1932 (July 31), p. 82—Lonauli, W. Ghats.

Not obtained by the Survey. The Brown Wood-Owl is found in Coorg and the Wynaad according to Jerdon and, in the latter area, William Davison says that it is less common than in the Nilgiris where it is fairly well known. Kinloch (*J.B.N.H.S.*, xxx, 484) mentions a specimen procured in the Nelliampathies in February.

The Brown Wood-Owl does not occur in Ferguson's list of Travancore birds, but Stuart Baker (*Nidification*, iii, 502) says that it is found in that State from the lowest to the highest hills.

How far this owl extends to the eastern side of the Presidency must for the present remain doubtful. There is a specimen in the Madras Museum said to have come from the Shevaroys and far further north, Jerdon says that it has been sent from Goomsoor. If this is correct these north-eastern birds may well be closer to the Himalayan race.

Nothing is known accurately about the breeding season in the Presidency beyond the fact that a juvenile specimen from Ootacamund (William Davison) in the British Museum is dated 3rd May. The identification of the supposed Travancore eggs mentioned by Stuart Baker (*loc. cit*) is evidently quite unreliable.

A series of birds from Ceylon compared with Nilgiri birds are definitely darker in colouration both above and below. The white throat patch is virtually absent and the facial disk is richer in colouration with more chestnut tint. They may be separated as *Strix indranee ochrogenys* (Hume).[1]

This species is often credited—in my opinion wrongly—with being the so-called 'Devil-bird' of South India and Ceylon. It is not clear whether the cries heard at night in Ceylon and South India proceed from the same species, but the evidence as to their authors is very contradictory. See Legge, p. 158; *Stray Feathers*, ii, 342; iii, 332; vii, 253; *J.B.N.H.S.*, xxx, 484.

Strix ocellata (Lesson).

Syrnium ocellatum Lesson, Rev. Zool., October-November 1839, p. 289—Pondicherry.

Not procured by the Survey in spite of Jerdon's statement that he had found it most numerous in the Carnatic. The only definite records for the Mottled Wood-Owl in the eastern side of the Presidency are its inclusion in Dewar's list and the specimens in the Madras Museum labelled respectively Madras and Singaperumal Coil, Chingleput, to say nothing of the type locality Pondicherry.

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[1] *Syrnium ochrogenys* Hume, *Stray Feathers*, vol. i (1873), p. 431—Ceylon.

On the western side William Davison was unable to include the species in his Nilgiri paper but Hume entered a note (*S.F.*, x, 343) that he knew of it on the southern base of the Nilgiris, north of the Collegal taluk.

In Travancore according to Ferguson the Mottled Wood-Owl is fairly common from Arukkutty to Vycome and he also mentions two specimens shot by his collectors at Perumbalam, an island in the Vembanad lake, in January 1903.

There is no reliable information about the breeding season in the Presidency.

This owl has no races in its limited range.

Ketupa zeylonensis leschenaulti (Temminck).

Strix leschenaulti Temm. & Lang., Planch. Col., pl. 20, livr, 4a (18 December 1824)—Chandranagore.

Specimen collected:—389 ♀ 12-6-29 Chitteri range 3,000 ft.

Measurements:—Bill 53.5, wing 392, tail 190, tarsus 71 mm.

There is a specimen of the Brown Fish-Owl in the Madras Museum from Covelong[1], a locality which I have been unable to locate precisely. With this exception the Survey specimen provides the only record for the eastern side.

In Travancore Ferguson says that it is common in forest land in the low country near the coast. Elwes also confirms (*Ibis* 1870, p. 527) that it is common in the lower valleys of the Cardamum Hills. In the Palnis Fairbank tells us that one was shot in the grove at Kodaikanal in April 1867 and that on his subsequent visit a pair were to be heard in the same locality every evening. Terry in his turn heard them in the same place.

Jerdon says that this Fish-Owl is not rare at Ootacamund and Primrose (*J.B.N.H.S.*, xvi, 163) confirms that it is common in the Nilgiris and adds that it is still commoner in the Wynaad.

Ferguson gives the breeding season in Travancore as March and April.

Ticehurst (*Ibis* 1923, p. 236 and *J.B.N.H.S.*, xxxiv, p. 473) has pointed out that in his opinion only one race of this species can be recognised in India, an opinion to which I have also independently arrived. Mr. Stuart Baker, however, recognises three races in India apart from the typical race in Ceylon. This last on our present material certainly seems recognisable on its darker colour and smaller size (wing 365-383 mm.).

Bubo bubo bengalensis (Franklin).

Otus bengalensis Franklin, P.Z.S. 1830-31 (October 25, 1831), p. 115—the Ganges between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mundela.

Specimen collected:—462 ♀ 22-6-1929, Tirthamalai 1,000 ft.

Measurements:—Bill 44.5, wing 382, tail 194, tarsus 68 mm.

Jerdon says that there is not a rocky hill in the Carnatic where the Rock Horned-Owl is not to be seen, and it is interesting to record that the statement is still true today. Captain Bates has written to me 'I have never gone near any of the low bush-covered rocky hills so typical of the landscape immediately south of Madras without finding a pair of these fine owls inhabiting each hill'. There is nothing to show the further distribution on the eastern side of the Presidency beyond the above Survey specimen.

On the west it is only recorded from the Nilgiris, though here it appears to be rare. Jerdon says that he had killed it on the Nilgiris in dense woods. William Davison says that he had flushed it twice for certain, besides probably seeing it on other occasions. This statement is verified by a male in the British Museum killed by Davison at Ootacamund on 8 January 1887.

It will be noticed that the distribution of the Rock Horned-Owl is wrongly given in the *New Fauna* (iv, 415) and *Nidification* (iii, 511) as extending south only to Khandesh and the Deccan. This species is very variable in colour, exhibiting paler, more buffy and richer, more rufous phases. There also appears to be a slight increase of size from south to north throughout the Peninsula and Himalayas as pointed out by Mr. Stuart Baker, but I am of opinion that it is impossible to recognise more than one race in our area.

There is nothing on record about the breeding season in the Presidency.

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[1] Kovalam (Travancore)?—Eds.

[**Bubo coromandus** (Latham).

Strix coromanda Latham, Index Orn., vol. i (1790), p. 53—Coromandel Coast.

According to Jerdon the Dusky Horned-Owl is found in the Carnatic in the more wooded parts and near hills, while Cardew is stated (*Birds of South India,* p. 213) to have obtained it at Ootacamund. This species appears to have been satisfactorily identified in Mysore (see Taylor, *S.F.*, x, 455). So the above records may be correct, but until further substantiation is forthcoming I feel that this bird cannot satisfactorily be admitted to the Presidency list.].

Huhua nipalensis nipalensis (Hodgson).

Bubo nipalensis Hodgson, Asiat. Res., vol. xix (after September 1836), p. 172—Nepal.

Specimen collected:—284 ♀ 25-5-29 Shevaroy Hills 4,000 ft.

Measurements:—Bill 51, wing 438, tail 225, tarsus 56 mm.

This specimen extends the known range of the Forest Eagle Owl which has hitherto only been known to occur in the Presidency on the western side.

In Coorg according to Betts it is widely distributed though nowhere numerous. In the Wynaad Primrose tells us that he twice was lucky enough to meet with it (*J.B.N.H.S.,* xvi, 163).

In the Nilgiris it occurs sparingly in the larger sholas, according to William Davison, being seldom seen except when the sholas are beaten for game, though Mr. Betts informs me that he has on occasion seen it perched on boulders or trees by the road at night. Major Phythian-Adams records (*Birds of S. India,* p. 214) that he shot four when beating sholas near Ootacamund in September 1927. Captain Bates informs me that he met with a young bird just able to fly on April 4 near Kotagiri.

In Travancore Ferguson considered it uncommon. He mentions receiving two live specimens which lived in captivity for some years, and that one was shot in the High Range (*J.B.N.H.S.*, xii, 203; xv, 667). Stewart evidently met with a good many nests in Travancore and found it breeding in December and January (*New Fauna,* iv, 418).

Sexed specimens are rare in collections, but seven birds from the Himalayas measure:—bill 54.5-59.5, wing 425-468, tail 213-242 mm. Ceylon birds are evidently smaller; three specimens in the British Museum measure:—bill 50.5-55.5, wing 370 (damaged) to 412, tail 184-215 mm. Their upper parts appear darker and the bars on the lower plumage are narrower and less numerous.

The single Survey specimen evidently belongs to the typical race, but I have seen no other specimen from Southern India, and until it is possible to settle whether Travancore birds agree with the Himalayan or the Cinghalese form it is impossible to settle the name for the latter. If they agree with Travancore birds the name *Huhua pectoralis* Jerdon, Madr. Jour. Lit. Sci., vol. x (1840), p. 89, pl. i (Malabar) is available. If, however, Travancore birds agree with the typical race the Ceylon bird will stand as *Huhua nipalensis blighi* Legge, Birds of Ceylon, pt. i (1878), p. 133 (Kandyan district, Ceylon).

The genus *Huhua* is separated from *Bubo* on the ground that the young has a perfectly distinct plumage from the adult. This is correct as regards *Huhua*, but it must be remembered that the juvenile plumage of *Bubo coromandus* is also different to that of the adult in colour and pattern. The difference may not be striking but it exists and it is problematical, therefore, whether the genus *Huhua* is worth maintaining merely on a question of degree.

Otus bakkamoena bakkamoena Pennant.

Otus bakkamoena Pennant, Indian Zoology, vol. i (1769), p. 3, pl. 3—Ceylon.

Not obtained by the Survey. There is very little accurate information about the Collared Scops-Owl in the Presidency but it must occur in the forests of the Eastern Ghats where Jerdon apparently obtained several specimens (Madras Jour. Lit. Sci. 1844, p. 120). Its occurrence at Ferahabad (over the boundary on the Ghats in Hyderabad territory) has been recorded (*J.B.N.H.S.*, xxxvii, p. 141) and it appears probable that these Eastern Ghats birds may not belong to the typical race.

In Travancore it is said to be very common throughout the low country and foothills, occurring also up to 2,000 ft. (Ferguson, *J.B.N.H.S.*, xv, 667 and Bourdillon apud *Nidification*, iii, 516). There are two specimens in the British Museum from Trivandrum (Fry and Nair) and three from Mynall (Bourdillon). These last are mentioned in *Stray Feathers*, vii, p. 34 as having been reared from the nest.

In the Nilgiris it occurs up to about 4,000 ft. and where it occurs it is apparently common, according to William Davison, for every night its rather melancholy double metallic hoot is sure to be heard. Specimens from Coonoor (♀ 16-5-69 Carter) and Kotagherry (♀ 9-1-75 Cockburn) are in the British Museum. Primrose (*J.B.N.H.S.*, xvi, 163) suggests that it is still more common in the Wynaad while Jerdon seems to have obtained it near the Peria Pass (*Madras Jour. Lit. Sci.* 1839, p. 89).

Nine other specimens from 'Madras' and 'Malabar' in the British Museum merely confirm the above information.

The Collared Scops Owl is evidently resident and the breeding season is said to be in January and February (*Nidification*, iii, 516).

Otus sunia rufipennis (Sharpe).

Scops rufipennis Sharpe, Cat. Birds Brit. Mus., vol. ii (1875), p. 60—Madras, Eastern Ghats.

Not procured by the Survey. Although from the number of specimens in the British Museum—unfortunately without precise data—it is evident that the Indian Scops Owl is not uncommon in the Presidency there is very little precise information about it. Jerdon says (*Madras Jour. Lit. Sci.* 1844, p. 119) that the first specimen he saw was found dead at Madras and that he had since obtained it from the forests of the Eastern Ghats. Dewar gives it without comment in his Madras list, no doubt on the strength of the local specimen in the Madras Museum. Of the eight specimens (including the type) in the British Museum marked 'Madras' some appear to come from Madras itself. Mr. Daly is said to have taken eggs in the Shevaroys. (*Old Fauna*, iii, p. 294).

On the western side Hume received a pair from the Wynaad (*S.F.*, x, 343) and William Davison obtained a specimen on the 12th December at Segore which is in the British Museum together with a male collected by Miss Cockburn at Kotagherry on 3 November 1874. A female collected by R. H. Morgan in the Palghat Hills in April 1876 is also in the British Museum.

Three Anjengo specimens in the British Museum are all we know about the occurrence of the Indian Scops Owl in Travancore.

It is presumably a resident in the Presidency but there is no information about the breeding season. The rufous and grey phases appear to be equally common. I can find no information about the call note of this race but as both *Otus sunia sunia* (*Ibis* 1926, p. 752) and *Otus sunia leggei* Phillips, (*Ceylon Jour. Science*, xvii, 1933, p. 98) have the same call note, it seems safe to attribute it also to the present race. This is not as described in the *New Fauna* (iv, pp. 435-6) but may be expressed by the words *wukh-tuk-tah* or *wuck-chug-chug* uttered loudly enough to be heard several hundred yards away and repeated endlessly in a very regular and rhythmic manner, like the swinging of a giant pendulum or the working of a pump-engine.

Athene brama brama (Temminck).

Strix brama Temminck, Planch. Color. d'Ois. livr. xii (1823), pl. 68—Pondicherry.

Specimens collected: 51 ♀ 14-4-29 Kurumbapatti; 274 ♂ juv. 23-5-29 Shevaroy Hills 4,000 ft.; 687 ♂ 13-8-29 Palkonda Hills 500 ft.; 931 ♀ 19-10-29 Seschachalam Hills 2,000 ft.; 956 ♂ 1-11-29 Nallamalai range 2,000 ft.; 1302 ♀ 24-1-30 Godavery delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	19.5-20.5	147-152	67.5-69	25-26.5 mm.
3 ♀	20-20.5	151-160.5	69-78	29.5-31.5 mm.

There appears as yet to be no record of the Spotted Owlet in the north-eastern area of the Presidency above the Godavery delta, but southwards of the delta it appears to be generally common and there is no need to cite the records. A pair obtained on Rameswaram Island on 17 March 1873 at the close of Hume's trip to the Laccadives are in the British Museum.

On the western side there is less known about this owlet. In Travancore according to Ferguson it is very common in the low country especially about Cape Comorin where numbers may be found in the ruined fortifications of the old Travancore lines. Ferguson says that it does not ascend the hills but in *Nidification* (iii, 525) Stuart Baker says that it is found in the Travancore hills up to 1,000 ft. or 1,500 ft. Specimens from Chittoor (2-1-73 Dr. Day), Segore (♂ 19-2-81 William Davison) and Coorg (Tweedale Collection) are in the British Museum but William Davison's account (*S.F.*, x, 344) of the commonness of this owl in the plains (whether of Mysore or the Presidency is not made clear) suggests that these three isolated records do not give a true picture of the status of the bird in the west. This owl is of course a resident species.

Ferguson says that the breeding season in Travancore is in March and April.

The Spotted Owlet does not occur in Ceylon. There are only two races in India. The typical race is small and dark whereas *A. b. indica* of Northern India is larger and of a paler colouration. There is, of course, complete intergradation between the two forms, both in colour and size, and there is the further complication that individual birds may vary considerably in colour. A Punjab bird in Mr. Waie's collection, for instance, is as dark as any specimen from Travancore.

Accepting specimens from the following areas as truly representing the typical race, viz. from Rameswaram Island, Travancore, Biligirirangan Hills, S. Mysore, Salem District, the Palkonda Hills and the Seschachalam Hills—I find that it measures as follows:—

	Bill.	Wing.	Tail.
7 ♂	19-21	141-158	66-71.5 mm.
6 ♀	20-22	151-156.5	68-73.5 mm.

whereas a series *A. b. indica* from the Punjab measures:—

	Bill.	Wing.	Tail.
12 ♂	19-20	153-167	74.5-83 mm.
5 ♀	18.5-20.5	159-167	73.5-83.5 mm.

With these comparative measurements before me I find that practically all specimens up to the Tapti river agree in colour and a high proportion agree in measurement with the typical race. No precise boundary can be fixed between the two races because of their intergradation, but in view of the above I propose as a matter of convenience to recognise the 20° N. lat. as the dividing line. Mr. Stuart Baker's division at the 14° (*New Fauna*, iv, 439) is in my opinion certainly too far south.

Glaucidium radiatum radiatum (Tickell.).

Strix radiata Tickell, J.A.S.B., vol. ii (December 1833), p. 572—Borabhum.

No specimens of the Jungle Owlet were collected by the Survey and little is known about the typical race in the Presidency. Ball records it from Jeypore (*S.F.*, vii, 201).

In the Nilgiris according to William Davison the Jungle Owlet ascends the hills as high as Coonoor, being however more common on the lower slopes and at the foot of the hills. Primrose (*J.B.N.H.S.*, xvi, 164) records seeing it as high as 5,000 ft. in a shola near the Terramia T. E. Stragglers however go higher as a specimen in my own collection was shot by Col. H. R. Baker at Ootacamund. This bird, like specimens in the Hume Collection from Segore (♂ 22-8-21), Kullar (♂ 17-10-67, o? 16-9-69) and Kotagherry (♂ 26-11-74 Cockburn) all definitely belong to the typical race and not to the richly coloured *malabaricum*. The explanation doubtless is that in the Nilgiris, as Mr. Betts informs me, this owlet is not a bird of the western slopes but belongs to the drier facies. This species forms the subject of an interesting discussion by Vidal and Hume (*S.F.*, ix, 38-39) on the connection between depth of colouration and rainfall and it is a particularly interesting example in view of its status in Ceylon. In that island it is a bird of the dry region and in consequence

Ceylonese examples agree with the typical race and not the Malabar form. This point was first made clear by Legge and is confirmed by a specimen in the British Museum. Unfortunately this interesting point is missed by the *New Fauna* (iv, 449) where Ceylon birds are attributed to *malabaricum*. The same paragraph contains a further mistake. Intermediate examples came from North Kanara and South Konkan not from Khandesh. There is a good series of Khandesh specimens in the British Museum and they are most typical *radiatum*.

Some examples of the typical race are much greyer than others, more particularly on the lower back and tail. This appears to have no connection with distribution but to be individual variation, no doubt representing the grey phase found in most owls.

The only record of the breeding season in the Presidency is furnished by *N. & E.*, iii, 112 when Mr. J. Darling Jnr. found a nest with two eggs at Coonoor on 12 March.

Glaucidium radiatum malabaricum (Blyth).

Athene malabaricus Blyth, J.A.S.B., vol. xv (1846), p. 280—Malabar Coast.

This race of the Jungle Owlet is confined to the western side of the Presidency and was therefore not met by the Survey. There are two specimens from Coorg in the Tweeddale collection in the British Museum and Colonel Sparrow has kindly lent me a male collected on 23 April 1912 at Malappuram. As Jerdon says, it also occurs in Cochin and Travancore and there is a good series from the latter state in the British Museum. Bourdillon and Ferguson tell us that it is common both in the low country and on the lower slopes of the hills in Travancore, sometimes ascending to 2,500 ft.

The breeding season in Travancore is said to be from March to May.

Ninox scutulata hirsuta Temm. & Lang.

Strix hirsuta Temm. & Lang., Planch. Color. d'Ois., livr, 49 (28 August 1824), pl. 289—Ceylon.

The Brown Hawk-Owl was not procured by the Survey and its distribution in the Presidency is not satisfactorily known.

In Travancore it is not uncommon in the hills in a zone between 2,000-3,000 ft. and is also said to occur in forest in the low country (Bourdillon and Ferguson). Three males from Mynall (Bourdillon) dated 3-12-1874, 24-2-1878 and 26-11-1879 are in the British Museum as well as two Anjengo specimens. This owl has not been recorded from the Nilgiris, but William Davison says that he heard it almost nightly in the Wynaad and the Brahmagherries, though he was unable to procure a specimen. There are however two birds from Coorg in the Tweeddale Collection.

The breeding season in Travancore is said to be from January to May (Bourdillon apud *Nidification*, iii, 536) and the bird is presumably resident.

I cannot separate birds from Ceylon and South India, and they appear to differ in size from the only Sumatran specimen which I have seen.

The Brown Hawk-Owl also occurs on the eastern side of the Presidency for Jerdon says that he met it in the Carnatic, and a specimen in the Madras Museum was apparently procured locally. There are moreover two birds in the British Museum labelled Madras, March 1877 and April 1876 (William Davison). These specimens appear to belong to the paler race *N. s. lugubris* which suggests that Madras here refers to the capital, and that eastern birds generally belong to that race which occurs as near as Raipur (Central Provinces). The point merits investigation.

Pandion haliaëtus haliaëtus (Linn).

Falco haliaëtus Linn., Syst. Nat., ed. x, vol. i (1758), p. 91—Sweden.

The Osprey is a cold weather visitor to the lakes near the Coast in Travancore according to Ferguson and at Madras Dewar says that some are to be seen fishing in most of the backwaters. The Osprey was not met by the Survey, and the only other record for the Presidency that I can trace is a female in the Hume Collection dated 1867. This appears to have been killed at a locality Thervoneedian which I am unable to find in any map.

Sarcogyps calvus (Scopoli).

Vultur calvus Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 85—No locality. Based on Sonnerat, Voyage aux Indes 1782, pl. 104, Vautour Royal de Pondicherry, and therefore now restricted to Pondicherry.

The King Vulture is, no doubt, generally distributed in small numbers throughout the Presidency as in the rest of India. LaPersonne reports it as seen by the Survey in the hills at Sankrametta and over the Shevaroys. Dewar includes it in his Madras list and Captain Bates gives me details of a nest found in a tope near St. Thomas' Mount on May 31st. On that date it contained a young bird which was still in the nest at the very end of June.

In the Wynaad and the Nilgiris it is not common, according to William Davison; and there appears to be some doubt regarding Primrose's note (*J.B.N.H.S.*, xvi, 164) on it in these areas, as he writes of it as breeding on the precipices, a habit that has never been confirmed.

For the Palnis Fairbank says that he observed it rarely at the base of the hills, while Terry says that he used to see one and very often a pair almost every day near his camp at Pulungi. A well-marked egg was taken by Howard Campbell at Kodaikanal (Stuart Baker, *Nidification*, iv, 7).

Ferguson received a live specimen from Colasagram, a locality close to the hills in South Travancore.

Gyps indicus indicus (Scopoli).

Vultur indicus Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 85—No locality. Based on Sonnerat, Voyage aux Indes, vol. ii (1785), pl. 105, Le grand Vautour des Indes. Now restricted to Pondicherry.

The Indian Long-billed Vulture is best known from the western side of the Presidency where it is found in small numbers through the Wynaad and the Nilgiris. It also occurs in the Palnis where Fairbank met it rarely at the base of the hills and Terry saw several at a carcase at Kukal. It seems to be scarce in Travancore as Ferguson merely mentions a live specimen brought in from Nagercoil.

This vulture breeds in the Nilgiris and also in the Shevaroys and from the latter hills there is a good description of two small breeding colonies examined by Packard (apud Stuart Baker, *Nidification*, iv, 11). A specimen from St. Thomas' Mount is in the Madras Museum.

The breeding season is said to be in December and January, but Stuart Baker mentions eggs taken as late as 3 March in the Nilgiris.

Pseudogyps bengalensis (Gmelin).

Vultur bengalensis Gmelin, Syst. Nat., vol. i (1788), p. 245—Bengal.

In the west of the Presidency the White-backed Vulture is the most common species, in Coorg, the Wynaad and the Nilgiris, appearing in hundreds at a carcase. In the Nelliampathies it only comes up from the plains as a temporary visitor, roosting there if gorged, according to Kinloch. There is no record for the Palnis, but in Travancore it is found throughout both the low country and the hills. Ferguson says that there used to be a breeding colony in a patch of forest near Oliver's Estate in the Ashambo Hills but this was destroyed in a clearance for coffee cultivation.

The only record for the eastern side of the Presidency is Dewar's inclusion of the name without comment in his Madras list.

Ferguson says that the breeding season in Travancore is from February to April.

Neophron percnopterus ginginianus (Latham).

Vultur ginginianus Latham, Index Orn., vol. i (1790), p. 7—Gingee, Coromandel Coast.

The Neophron appears to be somewhat irregularly distributed in the Presidency, and this fact will probably be found to have some connection with the distribution of rainfall. In Coorg, Betts only saw a single specimen, on 26 February 1929. In the Wynaad it is more common and over the slopes and plateau of the Nilgiris it is abundant, especially about Ootacamund, Kotagiri and the various Badaga villages, though it is seldom seen on the uninhabited western side of the plateau—as one would expect. Fischer has an interesting note (*J.B.N.H.S.*, xvii, 525) of six feeding on a hatch of termites at Geddisal, Coimbatore.

In the Nelliampathies it is scarce, Kinloch merely recording a single bird in some cooly lines on March 20. It is more common on the slopes of the Palnis up to 5,000 ft , occurring also occasionally up to the summits.

In Travancore it is common in the dry area of the extreme south about Nagercoil, but absent from the rest of the State.

On the eastern side there is very little information. The Survey reported a single bird on the Chitteri plateau. Captain Bates informs me that he took a hardset egg from a nest on the spire of the Garrison Church at St. Thomas' Mount on 14 March 1924, the birds building another nest and laying again when that was taken. In 1929 there was a nest in the same place with a large chick in July. Similarly Dewar says that there had been a nest for twenty years or more on the steeple of the Scotch Kirk at Madras.

A specimen from Kodambakam is in the Madras Museum.

(*To be contniued*).

EARLY DAYS IN MALAYA.

BY

H. E. BURGESS.

Malaya was a comparatively new country when I first went out there in the year 1900. It was only twenty-six years earlier—1874—that the British Government in Singapore became interested in its development, and at that time very little of the country had been explored. The three ports, Singapore, Penang and Malacca had come into our possession several decades earlier, but the Malay States which comprise all that part of the peninsula south of Siam, was for the most part virgin jungle. The construction of roads and railways had commenced at various centres, and a few miles of railway had already been opened for traffic, but the chief means of transport was by small boats on the rivers, where at scattered intervals along the banks, small villages were met with. Only small areas near by the villages were under cultivation which for the most part consisted of coconuts and arecanut palms. The centres where construction works had begun were the places of residence of the rulers of the four important states, and these had been made the headquarters of the four Governments, each under the control of a British Resident.

Hospitals, Courts and Police stations had been established, and the designs of these and other public buildings were of imposing structure, and significant as pointing to the future prosperity of the country.

It was noticeable that the small townships were being extended on a proper basis. No haphazard methods of building were permitted, while streets and water services were laid out on modern lines, and the result to-day is that, in a country which is notoriously unhealthy the towns themselves are as free from malaria and other tropical diseases as any of the larger towns in England.

At the time I speak of it was only these small towns which could boast any form of civilization and, except for the clearings near villages, all else consisted of jungle, unpopulated and infested with wild beasts. Certain areas had been opened up for tin mining, and some planters over from Ceylon had commenced to grow coffee, but in neither case were these areas extensive.

For the first ten years of my career out there I lived in the heart of the jungle, engaged at first in surveys and construction works, and later on in opening up large areas of land for rubber cultivation. Under such conditions it was only to be expected that I had ample opportunities of seeing wild life and being able to indulge in some big game shooting. My regret is that I did not take up the study of Natural History as I ought to have done, and for this reason I am afraid my notes will not be of much value from a scientific point of view. They are written at the instance of a friend who has suggested that a comparison with conditions in India would interest readers of this journal. Unfortunately, my knowledge of India is confined to the Nilgiri hills of the Madras province, where on the plateau the pine and rhododendron woods are non-tropical, and the scrub jungle at the foot hills does not compare with the immense trees and heavy undergrowth typical of Malayan forests. I have no doubt however, that such growth is found in the moist climates of Malabar and Travancore, and that the larger beasts of the jungle, and especially the greater carnivora, have the same characteristics.

I did a fair amount of shooting but was not bitten with the lust to kill, and I did not shoot with the idea of obtaining records. I was never keen to get an elephant, and after I had bagged my first two or three tigers and a few panthers. I did not go out after them unless I was appealed to by the villagers who were losing cattle and goats.

Before relating my experiences I must mention that certain birds and beasts of India are not found in Malaya. There are no vultures and no kites, and there are neither hyenas nor jackals. I was on the point of saying there were no crows, but recollect seeing some occasionally. I have seen only the jungle crow and these birds are never seen in towns and villages. The common song birds of the Nilgiris such as the thrush, the bulbul, and the blackbird, are either not found there or are very rare; and owing no doubt to the absence of tanks there is no duck shooting to be had. I never saw a wild duck and only once came across a few teal.

TIGER (Malay: *Harimau*).

My first district in Malaya, thirty-six years ago, was good tiger country. It was also recognized as the most unhealthy district on the map. I shot more tigers than any other European out there, and my bag was only thirteen. The only person who had got more than this number was the Sultan of Johore. I am speaking of fifteen years ago when we were able to compare notes. The Sultan had shot about twenty. Very few men have got as many as three or four, and several sportsmen who have bison and elephant to their credit have never shot a tiger.

When compared with the enormous bags obtained by many shikaris in India the numbers sound absurdly small, but I do not think it means that tigers there are comparatively less common. I am positive that as the country gets more opened up, more tigers will be seen. At present only about one-tenth of the land has been cleared of jungle, and the jungle itself is too big to permit of driving being done with success, and too dense for stalking. It is only in jungle of secondary growth that one has a chance.

Rewards are paid by Government for every dead tiger brought in to a Police station, and the majority of rewards are paid to Malays who, more often than not, get their tigers by the setting of spring guns. I had observed up to about ten years ago that the greatest number brought in for one year was ninety-six, and a comparison with India might be made by reckoning the respective areas of the two countries.

The general opinion among sportsmen in India is that the Malayan tiger is a smaller animal than his Indian cousin, but I am convinced this is not the case. I can vouch to shooting one which measured 9 ft. 8 in. between pegs, and although this was exceptional, one other measured 9 ft. 3 in. and another 9 ft. 0 in. All that I got were well conditioned and massive beasts, and of the forty or fifty trophies I have seen in India, and the half dozen or so I have seen killed on the Nilgiris, not one has compared with my big one, and all were much of an average with the full grown tiger of Malaya. There is one tiger at the Mysore Zoo which looks as heavy as my biggest, and it may possibly measure as much or more in length. I saw it from a distance in the parked enclosure and had not the best means to judge, but it certainly looked a very big one. The Commissioner of Police Perak—(Mr. Willes Douglas) who saw my big tiger interested himself afterwards in obtaining measurements, and some years later he wrote and told me that the next best taped only 9 ft. 4 in. (*N.B.* This was the Bukit Gantang man-eater referred to later on.) I may mention that all my big tigers, and the man-eater above mentioned, were shot in the one district in Perak. Of those I shot in Johore and Negri Sembilan none measured more than 8 ft. 8 in.

I have never done any shooting at night, and the majority of my tigers and panthers have been bagged between 11 a.m. and 6 p.m. I had a few thrilling experiences which I shall record in detail, and meanwhile will describe the methods I generally employed and which proved so successful. When a kill was located no one was permitted to approach nearer than twenty feet or so. A tree near by was selected, and on this tree a few planks were lashed together to form a seat. No elaborate machan was erected, and noise and other disturbances were practically nil. My five or six men were then told to go off about a quarter of a mile away. They were to keep together, moving more or less in a circle and at the same distance from the spot. They were to talk to one another all the time but were not to make a din, no shouting and beating of tins being permitted, and it was seldom I had to wait long before the tiger turned up to see that his kill had not been disturbed. The District Officer at Tampin, whose name I have unfortunately forgotten, mentioned to me that he had sat up a dozen times for a certain tiger which he had never even set eyes on, so I told him what I used to do and a few days after this I had a telegram from him to say he had bagged his tiger. I must not omit to say that I invariably built the platform at not less than twenty feet from the ground. My reasons for this were not for the sake of safety but because I felt it would minimise the chance of being detected by the tiger. It is probable that many a tiger has been lost for lack of this precaution.

My rifle, an H.V. 450-500 by E. M. Reilly, was a wonderfully accurate and hard hitting weapon, and usually I did not require to spend more than the one cartridge on a tiger or panther. I had put in a good deal of target practice and could invariably tell where my bullet had struck, and my proud boast was that I had never lost an animal which I had fired at. On one occasion I had an easy shot at twenty yards at a tiger immediately below me and I was surprised to see it bound off. I thought I had hit him right in the middle of the head. I was perfectly certain he was badly hit so I followed up immediately and came up to him walking ahead in a very dazed state when a second easy shot brought him to book. My rifle was not blamed for the slight error in the first shot as I realized I had taken a dose of quinine to ward off fever and that this had rather shaken my nerves.

My first tiger was got quite by chance. A friend and I strolled out one afternoon with our rifles hoping for a shot at a deer or wild pig, and we had not gone far when we came on to the tracks of a tiger which had crossed a bit of new road, where in the soft mud his pug marks showed him to be on the big side. I went a little way into the scrub to see where he had gone and suddenly to my horror I saw two full grown monsters facing me not twenty yards away. One was standing up, but the nearer one was crouching and looked the more dangerous of the two. There was not much time for thought, and firing quickly I dropped this one dead with a bullet through the brain. The other bounded away to the side with a tremendous roar, and when I turned round I found my friend in a terrible state of nerves. He had stopped behind to light his pipe and did not see me lift my rifle to shoot, and the sudden report and the roar of the tigress upset him very considerably. I discovered next day that the tigers had killed a big boar which at the time was behind us. We had evidently disturbed one and met them as they were both returning.

With the exception of two other exciting incidents which I shall relate, all my tigers were got by methods already mentioned.

One afternoon a Railway overseer came to tell me that he had seen a tiger prowling about near his house. He kept some goats in a shed, and the tiger had approached very near to this, but it moved away when it saw the man as he ran off to call me. I had one of his goats tied up on the edge of the jungle while I hid myself in an adjacent clump of sago palms. It was then about 5 p.m. and, as the tiger had not shewed up at dusk, I decided not to wait and called up my men. We started homewards through a rice field, a man with a lantern leading. I followed next and the man leading the goat came last. All went well for the first few yards when suddenly the tiger ran out with a roar and seized the goat. In the confusion that followed both my men fell and the lantern went out, and the best I could do in the circumstances was to fire a shot in the air. None of us saw the tiger and no one was hurt except for one man whose wrist was bruised by the rope attached to the goat and which was partly twisted round his wrist. When I went to investigate next morning I found the goat dead with its back broken, but otherwise untouched. I also came across the tracks of a tigress and two cubs.

I was living once in a small house close to the jungle and one morning there was great commotion which I guessed to be a fight between a tiger and a wild boar. There was no mistaking the sounds and my servants, very foolishly I thought, ran towards the spot and surprisingly managed to frighten the tiger away from the boar which he had just killed. I sent them back at once and took up a safe position in the leafy branches of a tree—in this case not more than about six feet from the ground. In five minutes the tiger was back, but instead of approaching the kill directly he went off at an angle. Not knowing what his intentions might be I risked a long shot and got in a smack behind the ear. He disappeared down a ravine and for the moment I thought I had lost him, but when I called out to the servants I heard him groan only a few yards away, and when we found him he was dead. He was a small beast, not quite full grown, and the boar also was on the small side.

A full grown tiger can kill the biggest of Malay buffaloes and I was curious to know what chance he would have against a bull bison. The following story provides proof to a certain point only. The bison killed the tiger, but the latter was rather an emaciated beast and had a festering wound in its shoulder. I was going down river once when I met a Japanese photographer coming up stream with a dead tiger on his boat. He said he had shot it and he produced a ·32 revolver as proof. The wound in the tiger's side looked as though a small cannon might have been used, and as the circumstances called for investigation, I prevailed on the gentleman to return with me to the spot. An inspection of the ground shewed that there had been a big fight between the tiger and a bison; and the bison although he had lost a lot of blood, apparently lived to fight another day, as we did not come up with him.

It must be very seldom that any one has witnessed a fight between a tiger and a wild boar, but it was my good fortune once to see such a fight from start to finish. I was being poled up the river Muar, and just as we were rounding a bend we spied a big boar crossing a sand spit on his way to drink. My boatmen quickly allowed the boat to drift into a clump of tall rushes where we were fairly well concealed, and as I was putting my rifle together I saw the boar suddenly turn round and face the jungle, and in the next instant a tiger walked out. It is difficult to describe what happened next—so quick were the movements on the part of both animals. They both charged and it looked as though they must meet with great force; but such speed was displayed in leaps and side steps that the result, in what seemed a second of time, was that they were facing one another again twenty feet apart, and the boar still with his back to the river. The same movements were repeated three or four times but I think the tiger must have done damage each time as the boar appeared to be weakening. The end came when the boar made a rush. With one movement the tiger side stepped and leapt on its back and was dragged like this into the jungle, where shortly the dying gasps of the pig told me that all was over. The sun had gone down and it was beginning to get dark, but thinking I might get in a chance shot I ran the boat in and stepped ashore. The tiger however was on his kill only a few yards inside the jungle, and the angry snarls he was making told us it would not be safe to approach any closer. My boatmen were shouting to me to get back into the boat and it was a great relief to all of us when we pushed off into mid-stream.

I shall conclude my notes on tigers with the story of the Bukit Gantang man-eater, but before proceeding to this I must tell of my one and only mishap in the Malayan jungles. I had arranged a drive through an area of scrub where it was known that a tiger used to lie up occasionally. No recent tracks had been seen, and it was purely speculative whether I would come across anything bigger than a pig. There were no big trees in the scrub and I had to take up a position all alone behind a small ant heap—the beaters knowing exactly where the position would be. After about half an hour, as they were coming towards me, I detected what I thought was the stealthy tread of a tiger at my back, and turning round I saw what I thought was unmistakably a tiger coming at me. I fired, and it was fortunate that for the first time my rifle did not kill. I had shot a man who had lost his way in the beat and was making his way back on all fours through heavy thorny scrub. I was congratulating myself on having got another tiger when almost immediately I heard a cry 'You have shot me, Sir'. As I have said, the man was down on all fours and facing me, and the bullet went under his chin, between his arms, and slightly grazing the stomach, entered the groin. He was rushed off to hospital and underwent a successful operation, but it was nearly a year before he was able to walk. Mr. Babo, the man in question, was a Malay of good family, and a thorough sportsman. At one time in hospital he was thought to be dying, and in the deposition he made he exonerated me from all blame, admitting that it was his own fault for coming behind me; and when after a year he was well enough to attend court on a summons to give evidence in the case the Police brought against me, he made the same statement. He was one of the last to call to bid me good-bye when I was leaving the country.

The Man-Eater of Bukit Gantang.

I was always told that a tiger takes to killing men only after it has grown old and is too feeble to catch fleeter and stronger game. This particular tiger was a fine beast and by no means past his prime. Surely a man-eating tigress must bring up her cubs on human flesh, and would not these cubs grow up to be man-eaters themselves? Certainly they would. The Bukit Gantang tiger acquired his delicate taste by accident. A Chinaman had two pigs which he kept in his bed-room. One night the tiger broke in and went off with the bigger one. The man not wanting to lose the other fenced it in under his bed, but the fence was a strong one and some nights afterwards the tiger being unable to break it down, went off with the man. I know this for a fact, and I also know that about a dozen men were taken in the next two months. It was due to a careless Chinaman that this tiger took to man-eating and I recollect how another careless Chinaman had a narrow escape from the same tiger. Every one knew about the man-eater and all the railway coolies had gone home except this one man. I was walking along the railway embankment when I came upon the tiger's tracks. There had just been a heavy shower of rain and he had gone by after the rain, which meant that he was only just ahead of me. Following up quickly I came on to this solitary old man breaking stone where a minute or two before the tiger had passed within ten feet or so. To my surprise the old man said he had not seen the tiger, but after I had gone on some distance he called me back and asked if I had meant a large yellow animal with black stripes, and if so he was sure now that he had seen it! I remember one other escape. A man was carrying a sack of pepper when the tiger sprang and went off with the sack instead of the man. Mr. Donaldson, District Officer, Matang, followed up and found the sack torn to shreds. I understand the man received so great a shock to his nerves that he would not venture outside his house for many months afterwards.

One exciting experience I recall very vividly. Early one morning while I was dressing upstairs I heard what sounded like a scuffle in a carpenter's shed near the bungalow, and on going down to see what it was all about, I saw that something very serious had happened. A bench and a table had been overturned and there was blood all over the place. My first thought was that murder had been done, but a tell-tale pug mark in the saw dust gave the tiger away, and within a few minutes two police men and I were hot on his tracks. The man had been dragged about half a mile up a water course, and as we approached we heard the tiger move away. When we found the body, only a small part of the thigh had been eaten, and as the tiger made no attempt to attack us I knew that nothing more could be done. Having shed man's blood he was afraid and would not return. It requires little imagination to realize what a feeling of dread pervaded the village, where it might be said death lurked behind every bush. Cattle and goats were penned by four o'clock in the afternoon, and the Malays and Chinese had to shut themselves up in their houses long before it was dark. I never ventured out without my rifle, and took good care not to get too near the jungle. It was a strange thing that this tiger frequently gave vocal notice of his intended visit to the village. He would call from about a mile away and repeat this at intervals till he got quite near, when there was a silence which was really ominous and oppressive. Excitement was intense as it was not known near which house the dread monster was looking for his next meal; and I imagine there must have been many sleepless nights in houses so flimsy of structure that one blow of the paw could have smashed in the thin plank walls. Some people were no doubt late in shutting up for the night, while gangs of coolies used to turn out to go to their work in the early hours of the morning almost before it was light, and the wonder to me is that the number taken was so few.

I was due for home leave and my passage had been booked for a date not far ahead, and it can be imagined how keen I was to get him before I left, and what trouble I went to in the matter, and yet success did not come to me. I had learnt fairly accurately the line he would take on his way down from the hills to the village, and I actually saw him twice without being able to get in a shot, and I had to leave with the feeling that if I could have possibly delayed my departure for a few days I should have brought him to book. He was killed very shortly afterwards by my own shikari who admitted to having set a spring gun on the tracks he had learnt when on his expeditions with me. The setting of a spring gun is an offence liable to severe punishment but in this case, not only was the man let off, but he was given the reward which had been raised to two hundred dollars. The tiger was a male in splendid condition, and, as I have stated, measured 9 ft. 4 in.

PANTHER (Malay: *Rimau kumbang*).

It is recognized that the spotted panther and the black panther are one and the same beast, the colouring of the latter being due to melanism. This being so it is strange that all panthers in Malaya are black. Certainly all that I have seen, whether in Perak in the north or Johore in the south, have been black ones. They are not easy to get, and I do not think any one else shot as many as the five that I did. They do not frequent the neighbourhood of towns and villages as in the case in India, and it is more commonly the tiger that does this in search of goats and dogs, which are quite a favourite food of his. I know that in India it is usually the panther which accounts for dogs, and that tigers are very rarely to blame, but in Malaya many a good dog has been taken by a tiger. I have many proofs of this; and in one planting district where in a radius of ten miles quite a number of dogs had been lost, none were taken after a tiger had been shot over a dog as bait. A husband and wife (Mr. and Mrs. Fenner) had their fox terrier snatched from almost under their feet by a big tiger. The Malay panther is a small animal, seldom measuring more than 6 ft. 6 in. Having shot so few I can recall all five incidents and in only one of these did I have exciting sport. I was using a theodolite on a hill top overlooking an extensive rice field when I happened to spot two animals crossing from big jungle to a small patch of scrub in the field, and bringing the telescope to bear on them I saw they were panthers. A large gang of men quickly surrounded the patch and we then commenced a drive. One broke very soon at full speed into the open, and I was able to bowl him over with one shot. We did not see the other and I am still at a loss to know how it escaped. The patch of scrub was quite small, and although we combed it pretty thoroughly the beast did not come out.

Wild Dog (Malay: *Angin hutan*).

I do not think that any of the Malays in the four districts I lived in were aware that wild dogs existed in their country. On the other hand it may be common in districts I do not know. I came across one only in the Larut district in Perak, and this one I shot and presented to the museum. There was already one specimen in the museum which I know to be the wild dog of India, but the one I shot was smaller, not so red, and without the black points. The difference in colour, size, and marking was perhaps due to the fact that it was not fully grown. A Malay found one of his goats one morning killed and partly eaten by what he described as some mysterious animal. There were several bites on the side and the entrails of the goat had been torn out, and further, no attempt had been made to drag it into the jungle. It was left just where it had been killed, in a patch of grass land. The Malay suggested either a tiger or a panther cub, but to me it looked more like the action of a wolf or a wild dog, and thinking that neither of these animals existed in the country I was completely nonplussed and all the more determined to know what it was. The kill had been made some time between nine and ten o'clock in the morning, and as I had no pressing work on hand I prepared to wait till nightfall if necessary. At two o'clock in the afternoon the dog came out, and when I saw there were no more to follow I shot him just as he commenced to feed.

Elephant (Malay: *Gajah*).

Elephants roam all over the peninsula and are common as far south as Johore. Unlike the elephant of Ceylon the male has tusks of fair size, and the tusks of one monster which charged and derailed a ballast train in Perak and was himself killed in the encounter, are certainly very big. They are in the museum in Taiping and I think are not far short of the measurements of the tusks secured by Major Gillespie five or six years ago in the Billigirirangan hills of Mysore.

With this exception, I have not seen any measuring more than 40 in., but since only a small fraction of the jungle has yet been cleared, the probabilities are that large herds have not been seen and that these herds contain specimens worth looking for.

I have mentioned that I had no desire to shoot an elephant, but I was much tempted to do so once when, at ten o'clock one morning, one of my assistants and I saw a big tusker walking through a field of rubber. The mere fact that he had tramped over half a mile of an area of young plants seemed sufficient justification for his being shot, as we felt that considerable damage must have been done, and snatching up our rifles we were soon in hot pursuit. Following up his tracks we were surprised to find that not even one plant had been crushed, but notwithstanding this our excitement carried us on, and presently we cornered him at a bend of a river which was in full flood. He saw us, but did not seem a bit concerned and, as the desire to kill had passed, I decided to turn round and make for home. We had actually gone back some distance when my friend J. B. thought it as well to have a pot at him to frighten him off, and he went back for this purpose. Presently I heard a shot and this was followed immediately by the sight of the young man with the elephant in close pursuit. They were in a patch of tall grass when J. B. suddenly disappeared and the elephant trotted over the spot where I had last sighted him. Luckily J. B. had fallen into a trench which the elephant stepped over, and he is still alive to tell the story, which is seldom believed! Small blame to the listeners, but J. B. is a truthful man and so am I. It appears that the elephant had charged before the shot was fired, and the probability is that the bullet went wide.

My Malay shikari told me that herds moved from one feeding ground to another at more or less regular monthly intervals, but not only was he not able to prove this but he shewed himself to be entirely wrong. For regularity in his habits however, I have not known any animal to beat a certain solitary bull whose return to the same spot every month was expected within a day or two. The villagers were always ready to receive him with crackers, and although he was frightened away each time, back again he came next month to meet with the same reception. He carried out this programme for many months, and perhaps for many years. It would have been an easy matter to kill him but I did not try, nor did I let on about his habits to others who might have been keen. I examined the spot on two occasions on the morning after the appointed day, and true enough I saw his tracks. I saw him two or three times at various other spots and had begun to look on him as an old friend. He did no damage on my property and never molested the coolies, but on one occasion he annoyed me very much when he walked along a new road trace and pulled up all the centre line pegs which I had put in at a good deal of personal trouble.

A Railway surveyor who had set out five miles of line woke up one morning to find all the important pegs gone. Pegs were put in at every chain, and at every tenth chain was a larger peg on which the true centre had been marked, and it was these pegs only which had been torn out and flung aside. The ordinary chain pegs were painted black, while the tenth peg was a white one.

My Chinese coolies who had evidently not previously seen an elephant did reverence to this one. When visiting their lines one morning I found the whole gang with their heads bowed to the ground and they told me that God had just gone by. The elephant had passed quite close to them and the tracks shewed that he had moved by quite slowly.

RHINOCEROS.

In all my thirty years in Malaya I knew of only two rhinoceros being killed. The one-horned rhinoceros (*R. sondaicus*) is very rare in that country and I believe that only three specimens have been obtained. One of these was shot by the late Mr. H. C. Barnard, in whose house in Taiping I saw the foot which he had mounted as an umbrella stand, and I recollect his telling me at the time (1901 or 1902) what a rare animal it was, and what difficulty he had in getting it. The two-horned animal (*R. sumatrensis*) is more common but I did not see any. In recent years one of these was shot by the Sultan of Johore, and, I was told, about that time, that another had been killed by an assistant on a rubber estate who got into trouble about it. H. H. The Sultan is very jealous as regards the protection of animals in his own jungles, and great credit is due to him for instituting game laws in his State, even before development of the country had begun. No enactments were passed and no licenses are issued, shooting being permitted only on permit signed by the Sultan himself. His example was slow to be followed in the four Federated States, but the appointment of a Game Warden was made about twelve years ago, and during the current year (1935) two thousand square miles of jungle have been defined as a game sanctuary.

THE GAUR (Malay: *Seladang*).

In Malaya, the Gaur or Indian bison goes by the name *Seladang*. It is the same beast and quite as big.

I shot two, both solitary bulls and both good specimens, but neither approaching the record.

Among Europeans, T. R. Hubback has shot more bison and elephant than any one else, and satiety being reached, he is probably the best man for the job of Game Warden which he now fills with much ability.

I had been some years in those parts before I was stationed in bison country, and it was a year or two after this that I was able to select my first. The game was new to me and I was much surprised to learn from men who had shot a number, that bison was the easiest to obtain of all the big beasts of the jungle, and I discovered that this was quite true if one wanted to shoot by the methods recommended. They come out to feed at night in grass country and it is quite an easy matter to intercept them in the morning on their way back to the jungle. This method did not appeal to me, and I am afraid I annoyed my tracker very much when, on the two occasions he had taken me out, I allowed some fine bulls to pass within sixty yards or so. I preferred to try stalking. With the promise of a reward as compensation for his two disappointments, my man did his best and shortly put me on to the tracks of a big solitary bull which had finished feeding and had moved off into the jungle. This was really exciting, and I pride myself that I managed to get the beast. The bison had been given time to enter the jungle before we arrived at the feeding ground and, as it had rained overnight, we were able to tell that he was not more than a quarter of an hour ahead. He had moved into jungle which almost baffles description, so intertwined was it with thorny creepers, that our only means of progress was along the tunnelled passage the bison had made.

I knew that it was a belt of only a few yards width and that we should presently come into more open scrub; but I also knew that although the going would be easier tracking might be more difficult for the reason that the bison might still be feeding and was likely to meander and so face us at any time. It took us about ten minutes to negotiate the narrow twenty yard belt, and, before we emerged, we carefully prospected the land ahead. It must not be imagined that the view was an extensive one, since although at the start we could see only three yards, we could now spot our beast up to perhaps twenty yards but certainly no further.

My Malay was down on his hands and knees. I was a yard behind moving one step at a time. While shaking like a leaf, I could not help thinking that I was a fool to take the risk. I prayed for a broadside shot, or a shot as he was moving off; but I dreaded facing him. While pondering these thoughts, I saw my man lie flat and point to something on the left. I could distinguish nothing, but presently knew that it was sound and not sight that raised the accusing finger, and that the noise was of the great beast chewing the cud. My man, I noticed, turned his head to the right, and instinct told me he was looking for a safe tree or log behind which to hide, and the probability is that the movement was noticed by the bison, as in the next instant he jumped up with a snort and stood directly facing me.

Another second and he might have turned round and bolted, or he might have charged and reached me, but within the second I fired and my bullet, which entered the throat just above the dewlap, caused him to crumple up only a yard nearer to me. My second shot was fired while he was struggling on the ground, and before he had made his last kick my Malay was cutting his throat. I must admit that all the time we were following up my nerves were on edge, but I seemed to be perfectly steady the moment I saw the bison. While tracking, I thought of my own personal danger only, but seeing the Malay had not flinched I felt he had shewn a hundred times more pluck than I had. His only weapon was a long jungle knife. In this hunt we had covered less than half a mile and it had taken us a full hour to do it. The distance paced between the dead bull and the spot where I was standing measured less than forty feet.

There is only one case on record in Malaya of a European having been killed by a bison. This was Capt. Syers, the Commissioner of Police. He had wounded a bison with his big bore, black powder rifle, and his second barrel was not sufficient to stop the beast when it charged. The bison's head is on view in the Selangor club, Kuala Lumpur.

SEROW (Malay: *Kambin grun*).

On certain limestone hills in Perak and Selangor there exists a type of wild goat, which although it may be fairly common, is very rarely seen. It happened that my first station was not far from one of these hills, and I was told that these goats were to be found there. The Malays call it the *Kambin grun* and it has been identified as the 'Serow'. I was also told that only one had been shot, and that Sir Frank Swettenham was the sportsman who got it. The hill that I speak of (Gunong Pondok) was of peculiar formation, rising as it did almost sheer from flat padi land to a height of over a thousand feet. There was next to no foothold on its steep sides, and I admit to defeat at my one and only attempt to gain the top.

I was anxious to see one of these animals, and, as my attempt to climb had failed, I looked to see what a telescope could do, and one day I actually did see one and one only. I saw it moving about for quite a long while, but it was more than half a mile away.

SAMBHAR (Malay: *Rusa*).

The biggest of stags carries no trophy worth keeping. I had to shoot a fair number because of the damage they did to young rubber, and not one of these carried antlers measuring more than twenty-seven inches.

WILD PIG (Malay: *Babi hutan*).

I have had very few opportunities of reading the Society's *Journal* and have not read anything about the wild pig, but I quite realize that much must have been already written about it, and that any new notes are likely to be put aside as being on a subject too common to be of interest. I have reasons, however, to write at some length about this because I have not been able to identify the particular '*Sus*' which has interested me. The common wild boar of India (*Sus cristatus*) is found all through Malaya, but there is another species which I have seen only twice. Its colour, shape, and habits are all distinct. Comparisons which I may possibly make very crudely will none the less be descriptive, and I enumerate these as follows:

1. The common Indian Wild Boar is of massive build, is black in colour, and is high at the shoulder. The other pig is smaller, and lightish brown in colour. It has a longer snout and the rise at the shoulder is not so pronounced.

2. The common pig moves about in small herds. On the two occasions I saw the second species they passed through the rubber estate in a herd over one hundred strong.

3. The common pig usually feeds at night. The others came out once at eleven o'clock in the morning, and on the second occasion at two in the afternoon.

4. The common pig seldom did damage on an estate, contenting itself with feeding on rubber seed which had fallen to the ground. The two herds mentioned did considerable damage to the roots of the trees in the short time they took to pass through the estate.

5. The common pig is very seldom killed owing to its cunning and nocturnal habits, and it must be very seldom indeed that it is killed by coolies who don't possess firearms.

On the occasions I speak of, Tamil coolies belonging to the estate were able to despatch with knives and sticks, about four or five in the first instance, and no less than eight the second time. Both herds were seen on the same rubber estate at a small place called Genuang, in Johore, and if I remember rightly, the first time was in 1911 and the second time in 1913.

Unfortunately, because of my lack of interest in Natural History at that time, I did not record details of a specimen which I felt then was out of the common. The species has since been identified as *Sus barbatus*. It was first recorded from Pahang in 1918 and reported on again, also in Pahang, in 1921. A note on the species was published in the *Bulletin of the Raffles Museum* (No. 5, August 1931), subsequent to which several specimens were obtained in Johore. I have mentioned that it is only in recent years that *Sus barbatus* has been seen in Malaya, and that its habits are very different to those of the common pig 'cristatus'.

I have just received a letter from a friend in Johore to whom I had sent copy of my notes, and what he writes is so interesting, that I feel I must pass on the information to your *Journal*.

My friend, Mr. Miller Mackay, who lives in Johore, has to make occasional visits to a rubber estate on the island of Kapala Djering in the Rhio Archipelago, and he tells me that about once in a year large herds of pig attack and do considerable damage to his rubber trees.

The common pig lives on the island but does no damage and it is only occasionally that the other pig is responsible. The island is a small one, and, while the common pig is frequently met with, the other one is never seen except for its periodical excursions on to the estate, and the conclusion is that it does not live there but must swim across from neighbouring islands. Mr. Mackay tells me that his Javanese coolies state they have actually seen herds swim over at nights. The nearest island is fully a mile away.

CROCODILE (Malay: *Buaya*).

Crocodiles are found in all the rivers and creeks on the west coast of the peninsula, and it is surprising what little alarm it causes the people. I have seen men bathing on one side of the river in full view of a monster croc basking on the opposite bank, while one sees boys under seven and eight years of age manoeuvring tiny shallow boats across a river infested with crocs. It is unusual for a crocodile to take to man-eating in the sense that a tiger does. I know of two, only one of which was a real man-eater. It was at a place called Buloh Kasap in the State of Johore. When I was living there I frequently had reports from Chinese shopkeepers and vegetable-growers that they had lost dogs and poultry which had strayed too near the water's edge. I did my best for them, but this beast was more cunning than several others I had shot further down stream.

He was never seen on the near side, and the far side which bordered the jungle was out of range. I got him eventually, and when he was cut up we found two dog-collars and a silver bangle, very bent and broken. A crowd had gathered round to watch the operation, and when the bangle came to light an old man burst into tears and said it was his little girl's bangle, and that she had been missing from the house since the previous morning. I had no proof that this particular crocodile had killed other people, and possibly the little girl was his first and only victim. Some years afterwards the District Officer (Mr. Wilson) told me that another crocodile, also at Buloh Kasap, had taken six or seven men, and was still at large at the time he spoke to me.

I shot my beast in 1905 and I think it was in 1918 that I met Mr. Wilson. I managed to shoot quite a number but none of them were very big. The largest measured about twelve feet, the biggest stuffed crocodile in the Raffles Museum, Singapore, measures 14½ ft. Its skull is 22 in. long. The Director of the Museum who very kindly gave me this information says that 'the largest crocodile skull (*C. porosus*) in the museum measures 26 in.' He adds that 'there is a well authenticated record of a crocodile (*C. porosus*) collected in 1820 in Luzon which had a skull measuring 34¾ in. The animal was 29 ft. long and 11 ft. in girth round the forelimbs.' In the same museum can be seen a crocodile with not a tooth in its head. It was shot by Mr. G. P. Owen on Singapore Island.

SNAKES.

There is a great variety of snakes in Malaya but only a few of these are poisonous. The cobra, a black variety, is quite common. I have killed at least twenty myself and have seen many more killed by others. The banded krait is not common, but I have shot three or four while out snipe shooting. The hamadryad is not often seen but the Malays in North Johore told me it was quite common in the Segamat district. I shot three and saw four or five others. These notes point to it that the country is not lacking in poisonous snakes, and yet it is a fact that deaths from snake-bite are rare. Thousands of people in India die of snake-bite every year, and in the thirty years I spent in Malaya I did not hear of even one case of a person being killed. It is recognized that the density of the population is nothing like what it is in India, but if it can be ascertained that persons have been bitten and that none have died, the theory must be advanced that the poison of the snakes there is less virulent. I once saw an Airedale dog recover after being struck on the ear by a big cobra. Nothing was done to the dog beyond washing the wound with a solution of carbolic acid. The cobra is of the black variety only, and has no marking on the hood—either monocellate or binocellate.

The brown cobra, the common colour form in India, I have never seen there. The Malay cobra seldom measures more than four feet. One often comes across them on rubber estates, and a few have been killed in houses, chiefly in the bath-room if this happens to be on the ground floor. It is very seldom indeed that snakes of any description are seen in the towns. I have mentioned that I have seen as many as seven or eight hamadryads. It was not always that I had a tape handy to make measurements, but to the best of my knowwledge, with one exception, none measured as much as thirteen feet. The exception is a very big one which was killed by a member of my staff, Mr. Stuart Mackay, who presented the skin to the Batu Anam Club. This specimen was of a darker colour than the others I had seen, but it was not black. It was about seventeen feet long, a few inches more or less, and as this is perhaps a record and a matter of interest, I have written for particulars to a doctor friend of mine still in that district.

Ninenty-nine per cent of the Europeans you meet in Malaya will tell you that the hamadryad will always attack a man whether it is provoked or not. My experience has taught me that this is not so. Like all other snakes, the hamadryad invariably tries to get out of Man's way; but like the cobra and certain other snakes, it will fight if cornered or to protect its young. It is a fast moving snake and if it was really out to kill, few men would escape. On two occasions I saw a hamadryad in an angry mood. Once while motoring along a straight bit of road I ran over the tail of one, and pulling up to see what might happen I saw the brute in the middle of the road with head raised and facing me. I had no gun and feeling sure he was about to make for me I moved off quickly.

On another occasion as one of my assistants was walking towards me in a new clearing I saw him turn round suddenly and run off as fast as he could and presently I spotted a big snake going after him.

Johnstone was a fair runner and he did not stop till he had done a good quarter mile. He was going in the direction of his house where I knew he kept a gun, and as I could not assist at the moment I remained where I was and soon had the satisfaction of seeing the snake return and climb into the hollow of a big tree stump. Johnstone returned shortly, fortified as he told me with a 'B and S' and with his gun. A lump of mud thrown at the tree brought out the snake which was shot. It was about ten feet long, and when we investigated the nest we found eight youngsters some just hatched and some about to hatch, and these we quickly despatched. The youngsters were all black, but the mother was the colour of the cobra of India. All the big hamadryads I have seen were of this light brown colour, but there is a plaster cast in the Singapore museum showing the snake as jet black, and I have wondered whether there are both black and brown adults among these snakes. I am afraid I was not of an enquiring turn of mind at that time.

Another poisonous snake is a little beast measuring not more than twelve to fifteen inches. I say it is poisonous because the Malays told me so, and because they seemed to dread it more than they did the cobra. It has a habit of lying across a path and of not being disturbed by approaching foot-steps and for this reason is more frequently stepped on by bare feet than other snakes. In colour it is a shiny black, and has a red blob looking like sealing wax on its flat head. I did not see more than three or four of these snakes, and I do not think it is common.

The writing of these notes has helped me to recall many incidents almost forgotten, and they bring back memories of a happy past in a new country and among people which one grew to like, but while the work entailed has given me a great deal of interest and pleasure, I fear that this article will not be looked on in the same way by readers of the *Journal*, and I pass on all blame for faults to be found, or for inabilities to make the matter instructive from the Natural History reader's point of view, to the gentleman who induced and prevailed on my doing this.

I have written as a novice, and as such would beg indulgence.

P.S.—Since completing the article, my friend Dr. Hickey of Batu Anam has written as regards the skin of the hamadryad mentioned in these notes. He tells me that it measures 16 ft. 4½ in. I know that the skin of a tiger measures more than the tiger itself does between pegs, but whether this occurs where a snake is concerned, I am not informed. The skin has possibly shrunk, or perhaps a piece of the tail has come away.

SOME BUTTERFLIES OF NEPAL.

BY

MAJOR W. G. H. GOUGH.

(2nd K.E.O. Gurkha Rifles).

It has often been stated, both in this *Journal* and elsewhere, that a list of the butterflies of Nepal would be welcomed. As far as I have been able to ascertain no such list has ever been made before.

The present list does not pretend to be an exhaustive one; in fact it is impossible for it to be so for several reasons. It is, however, strictly accurate and I am much indebted to the late Mr. O. C. Ollenbach, F.E.S., for his kind assistance in checking through the lists for me. Any species about which doubt exists have been excluded, except where specifically mentioned.

The length of the list is also limited by the fact that I only had three months in Nepal: had I been there longer no doubt more species would have been obtained. During this time I had practically to rely on what I saw or caught myself, but I also had the opportunity of examining the collection of Mr. R. G. Kilburne, the Civil Engineer to the Nepal Government, which provided several examples of butterflies which appeared at other seasons of the year.

It is, however, possible that this list, although short, may serve as a foundation on which a complete list of the butterflies of Nepal may eventually be built up. The country forms the true meeting-point of the Palaearctic and Oriental types of butterflies, and as such is of considerable interest. The area in which collecting is possible is, however, very limited. Broadly speaking it consists of the road into the Valley of Nepal and the environs of the valley itself. The altitudes at which butterflies are obtainable therefore vary at present from 500 ft. to 7,000 ft. Anything beyond this range or outside this area is closed to the European and is likely to remain so.

One point requires to be mentioned. In the lists given below I have endeavoured to stick strictly to what I know to be facts. If, therefore, I state that a butterfly appears at a certain season or elevation it is not to be assumed that it does not appear at other seasons or elevations: I am only stating what I know to be actually the case.

PAPILIONIDAE.

1. **Troides aeacus** Fd.

Flies in September at about 3,500 ft. It is said to be found commonly in the Nepal Valley in the spring, particularly on the Ticona flower.

2. **Byasa aristolochiae aristolochiae** F.

Flies in September and October at about 4,500 ft., but does not appear to be common. The female var. *diphilus* also occurs.

3. **Byasa philoxenus philoxenus** Gray.
Flies from July to September at about 5,000 ft. to 7,000 ft. During this period it is very common.

4. **Byasa philoxenus polyeuctes** Db.
Found with *B. philoxenus philoxenus.* Nepal appears to be their true meeting-place.

5. **Papilio memnon agenor** L.
Flies in August and September in the Nepal Valley, but is not common. The female var. *alcanor* also occurs.

6. **Papilio protenor euprotenor** Fruh.
Very common in September and October at about 4,500 ft.

7. **Papilio polyctor ganesa** M.
Flies from July to October from 3,000 ft. to 5,000 ft. Common along the bottom of hills and in nalas.

8. **Papilio helenus helenus** L.
Common in September and October at about 4,500 ft.

9. **Papilio polytes romulus** Cr.
Exceedingly common from August to October at about 4,500 ft. Of the three forms of female, that resembling the male and that resembling *Byasa aristolochiae* are both very common. Only one specimen of the female resembling *B. hector* was seen in the Nepal Valley, in October.

10. **Papilio demoleus demoleus** L.
Flies from July to October from 500 ft. to 4,500 ft. Very common, particularly in September and October.

11. **Zetides cloanthus** Wd.
Flies from July to September from 4,000 ft. to 6,000 ft. Not common.

12. **Zetides sarpedon sarpedon** L.
Flies from July to October from 4,000 ft. to 6,000 ft. Common, particularly in September and October.

13. **Zetides agamemnon agamemnon** L.
Fairly common from August to October at about 4,500 ft.

PIERIDAE.

14. **Pieris canidia indica** Evans.
Flies from August to October at about 4,500 ft. Very common during September and October, during which time those on the wing appear to consist almost entirely of females.

15. **Aporia agathon agathon** Gray.
A specimen in Mr. Kilburne's collection.

16. **Delias singhapura agostina** Hew.
Flies in the Nepal Valley during September and October. Not common, and very difficult to take owing to its habit of flying round the tops of tall trees.

17. **Delias eucharis** Drury.
Only one specimen seen, in the Nepal Valley, at the end of October.

18. **Delias belladonna ithiela** But.
Not rare in September and October at 4,000 ft. to 6,000 ft.

19. **Delias descombesi leucacantha** Fruh.
Two specimens in Mr. Kilburne's collection. It was noticeable that in these specimens the black markings underneath were considerably paler than in specimens from Assam. Probably flies in the spring.

20. **Delias aglaia** L.
Not rare at 4,500 ft. in September and October.

21. **Delias thysbe pyramus** Wall.
Flies from August to October from 4,000 ft. to 6,000 ft. Very common in October.

22. **Catopsilia crocale** Cr.
One specimen taken at 3,500 ft. in October.

23. **Catopsilia pomona** F.
Uncommon in September and October at about 4,000 ft.

24. **Catopsilia pyranthe minna** Herbst.
Flies from July to October from 500 ft. to 4,000 ft. Not many seen but probably common at the lower elevations.

25. **Catopsilia florella gnoma** F.
Uncommon in October at about 4,000 ft.

26. **Gonepteryx rhamni nepalensis** Db.
Common from July to October from 4,000 ft. to 6,000 ft.

27. **Gonepteryx aspasia zaneka** M.
Flies in August at about 7,000 ft. Apparently rare.

28. **Terias venata venata** M.
Only one specimen seen at 3,500 ft. at the end of August.

29. **Terias laeta** Bdv.
One specimen taken at 4,500 ft. in October.

30. **Terias blanda silhetana** Wall.
Common from August to October at about 4,500 ft.

31. **Terias hecabe fimbriata** Wall.
A specimen in Mr. Kilburne's collection.

32. **Terias hecabe hecabe** L.
Fairly common from August to October at about 4,500 ft. The wet season form prevails until about the first week in September.

33. **Terias lacteola sarinoides** Fr.
A specimen taken in the Nepal Valley in October. Mr. Ollenbach remarks that he does not know the name. He thinks it is nearest *sari rotundalis*, but the brown patch at apex reaches both margins.

34. **Colias hyale hyale** L.
Flies in September and October from about 4,500 ft. to 7,000 ft. The female var. *pallida* also occurs. Not common, but is probably plentiful in the spring.

35. **Colias croceus edusina** But.
Not common from August to October at 7,000 ft.

36. **Ixias marianne.**
Very common at 1,000 ft. in November.

37. **Ixias pyrene satadra.**
Very common at 1,000 ft. in November.

38. **Hebomoia glaucippe glaucippe** L.
Fairly common in the Nepal Valley during the latter half of September and in October.

DANAIDAE.

39. **Danais aglea melanoides** M.
Exceedingly common at about 4,500 ft. in September and October.

40. **Danais melissa septentrionis** But.
Fairly common from August to October at about 4,000 ft.

41. **Danais plexippus** L.
Common from July to October from 500 ft. to 4,500 ft.

42. **Danais chrysippus** L.
Very common from July to October from 500 ft. to 4,500 ft.

43. **Euploea mulciber mulciber** Cr.
Common from August to October at about 4,500 ft.

44. **Euploea core core** Cr.
Very common from July to October from 500 ft. to 4,500 ft.

45. **Euploea core vermiculata** But.
One specimen taken in September at 3,500 ft. Probably common enough in the winter.

SATYRIDAE.

46. **Mycalesis mineus mineus** L.
Not common at 4,500 ft. in September and October.

47. **Mycalesis lepcha lepcha** M.
Flies in the Nepal Valley in October. Rare.

48. **Lethe sidonis vaivarta** Doh.
Flies in the Nepal Valley in October. Rare.

49. **Lethe rohria dyrta** Fd.
Flies in the Nepal Valley in October. Rare.

50. **Lethe confusa confusa** Aur.
Common at 4,500 ft. in October.

51. **Lethe verma sintica** Fruh.
Flies in August at about 7,000 ft. Rare.

52. **Lethe insana dinarbas** Hew.
Flies in August at about 7,000 ft. Rare.

53. **Orinoma damaris** Gray.
Rare at about 5,000 ft. in October.

54. **Aulocera saraswati** Koll.
Common in August and September at about 5,500 ft.

55. **Erebia scanda** Koll.
Very common in August and September at about 6,500 ft.

56. **Erebia annada coeca** Watkins.
A specimen in Mr. Kilburne's collection.

57. **Erebia hyagriva** M.
Very rare in September at about 6,000 ft.

58. **Ypthima lycus lycus** de N.
Flies in August and September at about 6,500 ft. Common in August.

59. **Ypthima nareda newara** M.
Flies in September at 4,500 ft.

60. **Ypthima hubneri hubneri** Kirby.
Flies in the Terai in August.

61. **Ypthima avanta avanta** M.
Rare at 4,500 ft. in August.

62. **Ypthima sakra nikoea** M.
Flies in August and September at about 6,500 ft.

63. **Ypthima sakra sakra** M.
Flies from August to October from 4,500 ft. to 7,000 ft. Common in August.

64. **Ypthima sakra austeni** M.
Rare in August at 7,000 ft. Probably the westernmost limit of its range.

65. **Orsotrioena medus medus** F.
Fairly common in thick jungle at about 4,500 ft. in September and October.

66. **Melanitis leda ismene** Cr.
Very common from August to October from 4,500 ft. to 7,000 ft. The wet-season form prevails until about the middle of September.

67. **Elymnias malelas malelas** Hew.
Flies at 4,500 ft. in September and October. Common in October.

NYMPHALIDAE.

68. **Sephisa chandra** M.
Not rare at about 5,000 ft. in October.

69. **Euripus consimilis consimilis** Wd.
One specimen taken at 1,000 ft. in August. It is heavily marked with black and is the same as *consimilis meridionalis* from South India.

70. **Diagora persimilis persimilis** Wd.
Very rare at 4,500 ft. in September.

71. **Hestina nama** Db.
Very common from August to October at about 6,500 ft.

72. **Stibochiona nicea nicea** Gray.
Flies in September at about 5,000 ft.

73. **Euthalia lepidea lepidea** But.
Flies from August to November. Fairly common in the Terai in the latter month.

74. **Euthalia sahadeva sahadeva** M.
Not rare from August to October from 4,500 ft. 7,000 ft.

75. **Limenitis dudu** Wd.
Flies in October at about 5,000 ft.

76. **Limenitis procris procris** Cr.
Flies in July and August at about 3,000 ft.

77. **Pantoporia cama** M.
Flies in October at about 4,500 ft.

78. **Pantoporia opalina opalina** Koll.
Flies in October at about 4,500 ft.

79. **Pantoporia opalina orientalis** El.
Flies from August to October from 4,500 ft. to 7,000 ft.

80. **Pantoporia perius** L.
Fairly common from August to October from 3,500 ft. to 7,000 ft.

81. **Neptis hylas varmona** M.
Not common at 4,500 ft. in October.

82. **Neptis hylas astola** M.
Very common from August to October from 4,500 ft. to 7,000 ft.

83. **Neptis hylas adara** M.
Fairly common in September and October at 4,500 ft.

84. **Neptis soma soma** M.
Not rare in October at 4,500 ft.

85. **Cyrestis thyodamas ganescha** Koll.
A specimen in Mr. Kilburne's collection.

86. **Hypolimnas misippus** L.
Flies in September at 4,500 ft. Only males were seen.

87. **Hypolimnas bolina** L.
Very common from July to October from 1,000 ft. to 7,000 ft.

88. **Kallima inachus huegeli** Koll.
Flies in October at 4,500 ft.

89. **Kallima inachus inachus** Bdv.
Flies in August.

90. **Precis hierta hierta** F.
Flies in July at about 6,000 ft.

91. **Precis hierta magna** Evans.
A specimen in Mr. Kilburne's collection which I take to be this, but there is so little difference between this and *hierta hierta* that it is difficult to tell with certainty.

92. **Precis orithya swinhoei** But.
Common from July to October from 4,500 ft. to 7,000 ft.

93. **Precis orithya ocyale** Hub.
A specimen in Mr. Kilburne's collection. Again, the difference between this and *swinhoei* is so slight that it is difficult to be certain.

94. **Precis lemonias persicaria** Fruh.
Flies at 3,500 ft. from August to October.

95. **Precis almana almana** L.
Flies from August to October at 4,500 ft. The wet-season form prevails until September.

96. **Precis atlites** L.
Very common at 4,500 ft. in October.

97. **Precis iphita siccata** Stich.
Flies from August to October from 4,500 ft. to 7,000 ft.

98. **Precis iphita iphita** Cr.
Flies from August to October from 4,500 ft. to 7,000 ft. I have included both the above, but once again there is so little difference between the two that it is difficult to be certain. The species is very common.

99. **Vanessa cardui** L.
Flies from August to October at 7,000 ft. For some reason it does not appear to be common.

100. **Vanessa indica indica** Herbst.
Very common from July to October from 4,500 ft. to 7,000 ft.

101. **Vanessa canace canace** L.
Common from August to October at 7,000 ft.

102. **Vanessa cashmirensis aesis** Fruh.
Flies from July to October from 4,500 ft. to 7,000 ft. Very common in August and September.

103. **Symbrenthia hippoclus khasiana** M.
A specimen in Mr. Kilburne's collection.

104. **Symbrenthia hypselis cotanda** M.
Flies in August and September from 4,500 ft. to 7,000 ft.

105. **Argynnis hyperbius hyperbius** L.
Common from August to October from 4,500 ft. to 7,000 ft.

106. **Argynnis childreni childreni** Gray.
Flies in October at about 6,000 ft.

107. **Argynnis lathonia issoea** Db.
Flies in October at 7,000 ft.

108. **Cupha erymanthis lotis** Sulz.
Flies in September at 4,500 ft.

109. **Atella phalanta** Drury.
Flies from August to October from 4,000 ft. to 6,000 ft. Common in the Nepal Valley in September.

110. **Issoria sinha sinha** Koll.
Flies from July to October from 500 ft. to 4,000 ft.

111. **Cethosia biblis tisamena** Fruh.
Very common at 4,500 ft. in September and October.

112. **Ergolis ariadne pallidior** Fruh.
Flies in October at 3,500 ft.

113. **Pareba vesta vesta** F.
Flies in August and September at 7,000 ft.

ERYCINIDAE.

114. **Libythea lepita lepita** M.
Flies in October from 4,500 ft. to 7,000 ft.

115. **Libythea myrrha sanguinalis** Fruh.
A specimen in Mr. Kilburne's collection.

116. **Zemeros flegyas indicus** Fruh.
Common from August to October from 5,000 ft. to 7,000 ft.

117. **Dodona durga** Koll.
Flies in October at 7,000 ft.

118. **Dodona dipoea nostia** Fruh.
Flies in October at 7,000 ft.

119. **Dodona eugenes eugenes** Bates.
Flies from August to October from 4,500 ft. to 7,000 ft.

120. **Dodona eugenes venox** Fruh.
Flies from August to October at 7,000 ft.

121. **Dodona egeon** Db.
Flies in October from 4,500 ft. to 7,000 ft.

122. **Dodona ouida ouida** M.
Flies in August at 7,000 ft.

123. **Dodona adonira adonira** Hew.
Flies from August to November from 5,000 ft. to 7,000 ft.

124. **Abisara fylla** Db.
Flies in October at about 6,000 ft.

LYCAENIDAE.

125. **Euchrysops cnejus** F.
Flies in August in the Terai.

126. **Everes argiades diporides** Chap.
Flies in October at 4,500 ft.

127. **Lycaenopsis marginata** de N.
Common in August at 7,000 ft.

128. **Lycaenopsis puspa gisca** Fruh.
Flies from July to October from 4,500 ft. to 7,000 ft.

129. **Lycaenopsis limbata placida** de N.
Flies in August at 7,000 ft.

130. **Lycaenopsis argiolus jynteana** de N.
Flies in August at 7,000 ft.

131. **Zizera maha maha** Koll.
Flies from August to October from 4,500 ft. to 7,000 ft.

132. **Zizera lysimon** Hub.
Flies in August and September from 4,500 ft. to 6,000 ft.

133. **Catachrysops strabo** F.
Flies in August at 4,500 ft.

134. **Catachrysops lithargyria** M.
Flies in the Terai in August.

135. **Lampides boeticus** L.
Flies in September at 4,500 ft.

136. **Jamides bochus bochus** Cr.
Flies in October at 7,000 ft.

137. **Jamides celeno celeno** Cr.
Flies from August to October from 1,000 ft. to 4,500 ft.

138. **Jamides elpis eurysaces** Fruh.
Flies in August at 4,500 ft.

139. **Heliophorus epicles indicus** Fruh.
Flies in October at 5,000 ft.

140. **Curetis thetis** Dry.
Flies in September at about 1,500 ft.

141. **Amblypodia eumolphus eumolphus** Cr.
Rare at 4,500 ft. in October. Very dark on the underside, but on the upperside much the same as specimens from Sikkim.

142. **Amblypodia areste areste** Hew.
A specimen in Mr. Kilburne's collection.

143. **Spindasis lohita himalayanus** M.
Flies in August at 4,500 ft.

144. **Deudoryx epijarbas ancus** Fruh.
Flies from August to October at 4,500 ft.

145. **Deudoryx epijarbas amatius** Fruh.
Flies in August and September at 4,500 ft.

146. **Virachola perse perse** Hew.
Flies in October at 4,500 ft.

147. **Rapala nissa nissa** Kollar.
A specimen in Mr. Kilburne's collection.

HESPERIIDAE.

148. **Rhopalocampta benjaminii benjaminii** Guer.
A specimen in Mr. Kilburne's collection.

149. **Badamia exclamationis** Fab.
Flies in August at 4,500 ft.

150. **Celaenorrhinus pulomaya** M.
Flies in September at 3,500 ft.

151. **Tagiades menaka** M.
Fairly common in October at 4,500 ft.

152. **Hesperia galba** F.
A specimen in Mr. Kilburne's collection.

153. **Udaspes folus** Cr.
Common in September at 4,500 ft.

154. **Notocrypta feisthamelii alysos** M.
A specimen in Mr. Kilburne's collection.

155. **Notocrypta curvifascia** Fd.
Flies in September at 4,500 ft.

156. **Erionota thrax thrax** L.
Flies in September and October at 4,500 ft.

157. **Baoris sinensis sinensis** Mab.
Flies in August from 4,500 ft. to 7,000 ft.

158. **Baoris conjuncta conjuncta** HS.
A specimen in Mr. Kilburne's collection believed to be this species.

159. **Baoris eltola** Hew.
Flies in October at 4,500 ft.

160. **Baoris guttatus guttatus** Brem.
Flies from August to October at 4,500 ft.

161. **Baoris guttatus bada,** M.
Flies in October at 4,500 ft.

162. **Baoris bevani bevani** M.
Flies from August to October at 4,500 ft.

CUCKOO-LORE.

BY

LIEUT.-COL. R. W. BURTON,

Indian Army (*Retired*).

Our hardworking Editors have asked that articles of general interest may be contributed to further popularize the *Journal* and attract more members.

In the back numbers of the *Journal*, all of which are not within reach of many of our members, is much information concerning cuckoos contributed by well-known ornithologists, chief among whom is Mr. Stuart Baker. He, and other notable observers whose recorded observations are now freely made use of, will no doubt forgive one who has no claim whatever to be considered an ornithologist, or oologist, in consideration of the laudable motive by which this article is inspired.

Of 'The Cuckoo in the Nest' and 'The Cuckoo in Harley Street' most of us have heard; and there are sundry expressions which have obtained permanent place in the English language. The Common Lily of Great Britain (*Arum maculatum*) known to our childhood as 'lords and ladies', is the 'cuckoo-pint'; the 'Ragged Robin' is the 'Cuckoo-Gilliflower'; and the Wryneck, commonly arriving in England a few days before the male cuckoo, is known as 'cuckoo's leader' or 'cuckoo's mate'; and there are 'cuckoo clocks' to be found in many a cottage home.

Then there is 'cuckoo-spit', the frothy secretion found upon plants and produced by the immature nymphal stage of various plant-lice, some of which, in the adult condition, are known as 'frog-hoppers'; and there are 'cuckoo-flies' which have some resemblance to the common house fly, and are parasitical on the larvae of other insects.

In Old English literature several rhymes anent the cuckoo are to be found, the most notable being 'The Cuckoo and the Nightingale' by Sir Thomas Clanvowe, published in 1532. There is a Cuckoo Song (*circa* 1250) of three stanzas, the first of which is:—

Sumer is icumen in,
Lhude sing cuccu!
Groweth sed, and bloweth med,
And springth the wude nu—Sing cuccu!

Then, about 1580, John Haywood wrote:—

In April the Cuckoo can sing her song by rote.
In May oft-time she cannot sing a note.
At first, koo, koo; koo, koo; sings till she can do
At last; kooke, kooke, kooke; six kooke's to one koo.

From the North of England comes:—

In April cuckoo says her lay;
In May she sings both night and day,
In June she loses her sweet strain,
In July she is off again.

which contains the misstatement, according to our modern knowledge, that it is the hen bird which sings.

Lastly there is a more recent lilt:—

The schoolboy wandering through the wood,
To pluck the primrose gay,
Starts, thy curious voice to hear,
And imitates thy lay.

which we can all remember to have done in our early days!

As a harbinger of spring the cuckoo is always welcome to the ears of those who have just passed through the severities of winter; and probably no single wild bird in creation has attracted so much popular attention, or has been so much written about, as the Common Cuckoo: yet, even to this day, there are matters still requiring investigation in regard to its habits and oology.

The Cuckoo of the United Kingdom is *Cuculus canorus.* It is found practically over the whole of Europe and Western Asia. Towards the end of March 'the harbinger of spring' proclaims his arrival by his loud far-sounding song—for song it is in the technical sense of the word, being confined to the male sex and the season of love. In a few days the hens arrive, and then can be noticed the amorous contests between keen and loud-voiced suitors. Even by night they are not silent, being particularly vocal by moonlight.

The birds avoid observation as much as possible, for they are frequently pursued by all the small birds of the neighbourhood, which take them to be hawks on account of their resemblance in appearance and flight to a bird of prey.

As the season advances the call alters, the voice 'breaks', and the bird is no more heard. By the middle of July an old bird is seldom seen. A male cuckoo has, however, been known to remain all the winter, and to call too! a very unusual and strange occurrence: perhaps the bird had suffered some injury to prevent migration.

In winter the European Cuckoo migrates across the Mediterranean to North Africa and visits Arabia, Persia and North-West India. 'A cuckoo ringed in a Pied Wagtail's nest near Eton, Buckinghamshire, met its end in a jungle clearing of the French Cameroons via the arrow of a native.' (*The Observer*, 5-11-1933.)

Much of the curiosity and interest attached to the cuckoo is caused by its singular habit of entrusting its offspring to foster-parents. In the United Kingdom, among the foster-parents more commonly selected are the Pied Wagtail, the Titlark, and the Hedge Sparrow, the last-named being particularly complacent in brooding eggs of wholly different colour to her own. There are some sixty British birds known to have been duped by the cuckoo; and in Europe the foster-parents selected cover a large assortment ranging from the tiny Fire Crested Wren to the larger shrike, so the cuckoo is no fool! 'Dr. Rey gives a list 146 such' (Stuart Baker, *Bombay Natural History Society's Journal*, vol. xvii, p. 80) (in future, for short, xvii, 80, and so on).

In India the number of observed foster-species of the Common Cuckoo[1] is 32 (Stuart Baker, xvii, 78 and 881 and xxii, 625) and doubtless there are many others which will be added to this list.

In the selection of the nest the female cuckoo is exceedingly cautious and secretive. Sometimes, when the nest is large enough and favourably situated, she will lay her egg in it; but in probably the large majority of cases she lays her egg on the ground and introduces it by her bill into the nest. For this action the bird is peculiarly fitted, the mouth being wide and the gape curiously flexible. Perhaps it is to aid this habit that the egg of *canorus*, considering the size of the bird, is remarkably small being about the same size as that of the skylark, a bird about a quarter of its size.

On occasion she will, when depositing her own egg, remove one of the rightful eggs from the nest; and sometimes two different hens will lay in the same nest. In such cases the weaker cuckoo of the two hatched out will suffer the usual fate. This dual laying is due to some vagrant cuckoo, unable to find a territory of her own, having through necessity to trespass on the area of another; and she will have to be exceedingly quick in her operations, for a dominant cuckoo, mistress of her own pitch, will brook no rival, especially if the latter be parasitic upon the same species as herself.

It is a remarkable circumstance that the cuckoo (*C. canorus*) places her eggs only in the nests of those birds which have soft bills and feed on insects and, like herself, have membranaceous stomachs suited to the soft food; while she avoids the nests of those birds that feed on grain and have strong muscular gizzards.

The food consists largely of hairy caterpillars, and on rare occasions the mother has been observed to feed its own young; while there is one reported instance (xvii, 79) of the Common Cuckoo hatching its own eggs and rearing the young.

In some cases the eggs have more or less resemblance to those of the foster-parents, and it may be a provision of Nature, increased by a process of natural selection, that the eggs laid by *canorus* as a whole vary much in appearance. And it is possibly by an inherited habit that a cuckoo will become parasitic on one particular species; it having been found by its ancestors that this particular species is more readily deceived, or is more tolerant to the imposition. There are many recorded observations in support of this.

It is unquestionable that whatever variations there may be among the eggs laid by different individuals of the same species, there is a strong family resemblance between eggs laid by the same individual, even after a lapse of years; and it can hardly be questioned that the eggs of the daughter would tend to resemble those of her mother.

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[1] The European Cuckoo (*Cuculus canorus canorus*) does not breed within Indian limits. The two allied forms breeding in our area are the Asiatic Cuckoo (*C. c. telephonus*) and the Khasia Hills Cuckoo (*C. c. bakeri*).—EDS.

In his Additional Cuckoo Notes (xvii, 876 et seq., and xviii, 275) Mr. Stuart Baker adds much to our knowledge of this subject; his observations being opened up by suggestions (1906) by Professor Burnett of Hyderabad.

> 'To commence with (p. 889) we have the broad fact that our Cuckoos which lay blue eggs—that is *Hierococcyx varius* (the Common Hawk Cuckoo) and the genus *Clamator* (the Crested Cuckoos)—practically invariably deposit their eggs in the nests of such birds which like themselves lay blue eggs. All over India fosterers of this description are available in considerable numbers and there is no further need for adaptation, and accordingly we find there is none, and no one has ever taken an egg of the above cuckoos of any other colour but blue. Of course there are rare exceptions to the usual fosterers selected, such as the egg of *Clamator jacobinus* (the Pied Crested Cuckoo) found in the nest of *Garrulax leucolophus* (the Himalayan White-crested Laughing Thrush) but these exceptions are too few to have any influence on either eggs or parent.'
>
> 'It is possible that the want of discrimination displayed by the Common Cuckoo as to where it should put its egg, has resulted in the marvellous variety of types and colours found in it. At the same time it is possible that the egg is more or less adapting itself to local requirements in those localities in which any one fosterer greatly predominates. To accord with this it is however necessary to presume that cuckoos are regular in their migratory habits and visit the same breeding range one generation after another.'
>
> Then as to the Small Cuckoo (*C. poliocephalus*) of India:—'On the whole, therefore, it may be taken as probable that the Small Cuckoo lays eggs which adapt themselves to their surroundings. The Indian Cuckoo (*C. micropterus*) lays very pale blue eggs and selects most often fosterers such as *T. lineatum* and *L. brunnea*, which also lay blue eggs. Here the colour of the Cuckoo's eggs would certainly seem to have adapted itself to that of the type of fosterer's egg with which it is generally found.'
>
> Of the Large Hawk Cuckoo (*H. sparveroides*), Mr. Stuart Baker finds that it adapts its egg in various parts of the country to the eggs of the selected foster-parent: and it is a fact that the Common Hawk Cuckoo 'has arrived at complete adaptation and invariably places its deep blue eggs in nests of fosterers which lay eggs of a similar colour'; (again: the cuckoo is no fool!) and he goes on to describe remarkable instances of what appears to be adaptation on the part of the Plaintive Cuckoo (*Cacomantis passerinus*) and closes with the remark that 'knowledge as to the eggs of other species of Indian cuckoos is not yet sufficient to allow of generalization.'

> And he finally sums up as follows:—(p. 892) 'On the whole, therefore, Indian Cuckoos would appear to adapt themselves more or less to producing eggs which to some extent resemble those of the birds they select as foster-parents to their young. In this way such Cuckoo's eggs as approach most nearly in colouration to those of the foster-parents would survive, whilst those which greatly differ would gradually be eliminated.'
>
> It may be that Nature is at work on these lines, but there are other views. Mr. Douglas Dewar is of opinion (xvii, 775) that the theory that Cuckoo's eggs are 'mimic' those of the host is not tenable; and Dr. Bernard Rensch of the University Zoological Museum, Berlin, is quoted as believing (xxxiv, 1068) 'that all the discrimination and selection is exercised exclusively by the hosts. Only such cuckoo's eggs as approximate in appearance to those of the hosts succeed in being accepted, while those that are obviously strange are either cast out or not incubated at all (i.e. nests are deserted). This manner of selection has evolved distinct groups among the cuckoos (each group laying a distinct type of egg), who from generation to generation resort for egg-laying only to the nests of such species as they themselves were fostered by. The selection exercised by the hosts, which destroys all eggs of strange appearance tends to "the survival of the fittest"; in other words it conduces to perfecting the resemblance between the eggs of the parasite and those of its host.'

The above quotation is from an article by Mr. Salim A. Ali in which he describes how he 'played cuckoo' on certain small birds to elucidate the matter; and so far as his few experiments go they appear to support Dr. Rensch.

The reader now has a fairly complete summary of this matter; and those specially interested can realize that there is plenty of scope for future observation in this field; more especially in India and the East.

To continue the habits of the European cuckoo (*C. canorus*). When the eggs are hatched there ensues the murderous eviction of the rightful tenants by the young cuckoo, who is especially equipped for the deed by his broad hollow back and disproportionately strong thighs, though his hollow back soon fills in (by the twelfth day) and the adult bird has rather weak than strong legs.

The eviction is effected by getting the tail under each egg, or young bird, in succession, wriggling them on to its back, and then cleverly pitching them over the side of the nest. In its earlier days only the eggs are evicted, the murderous deed being committed at a more advanced age. A young cuckoo has been observed to evict its brother in the nest, and probably always does so, victory being to the strongest.

An accurate observer of early in the last century (Jenner, quoted by Blackwall in the *Memoirs of the Literary and Philosophical Society of Manchester*) describes the process of eviction,

> 'The young cuckoo, soon after it is excluded from the egg, commences the extraordinary practice of turning out its companions, which are usually left to destruction. The mode of accomplishing this is very curious. With the assistance of its rump and wings it contrives to get a young bird upon its back; and making a lodgment for its burden by elevating its pinions, clambers backward with it up the side of the nest till it reaches the top, where, resting for a moment, it throws off the load with a jerk and quite disengages it from the nest. It remains in this situation for a short time, feeling about with the extremities of its wings as if to be convinced whether the business is properly executed, and then drops into the nest again.
>
> It frequently examines, as it were, an egg or nestling with the ends of its wings before it begins its operations; and the nice sensibility which these parts appear to possess seems sufficiently to compensate for the want of sight, of which sense it is at first destitute.'

Now we can say farewell to the young cuckoo which, having been well fed and cared for by his solicitous foster-parents, begins to shift for himself by the end of September and soon follows the remainder of his kin to more southern climes.

Let us now turn to the Indian Empire and see what there is known, or to be known, as to the many cuckoos in the various countries of diverse climates included within it.

For the reason that this article is primarily intended for the general reader (also to collect in one place all the 'cuckoo-lore' to be found in the *Journals* of the Society) it seems well, with the presumed permission of Mr. Stuart Baker, to give the following extract from his series of articles on 'The Oology of Indian Parasitic Cuckoos' published in 1906-07 in volume xvii of the *Journal.*

> 'Our Indian cuckoos of the family *Cuculidae* (the Order is *Coccyges*) are divided by scientists into two sub-families—the *Cuculinae* and the *Phoenicophainae*: the genera composing the former have the shanks or tarsi more or less feathered, whereas those of the latter have them quite naked. The only parasitic cuckoo belonging to this second group is the Common Indian Koel (*Eudynamis scolopaceus*), all our other parasitic cuckoos belonging to the former.
>
> The general outward appearance of the family is passerine, but the feet are zygodactyle, i.e., the first and fourth toes both point backwards, as in woodpeckers and others. The feet and legs are also, as a rule, exceptionally feeble, but the wings are strong, and generally long and pointed, so that cuckoos have swift flight; the bill is slightly curved throughout, the gape rather wide and frequently conspicuously coloured.
>
> The species of the genus *Cuculus*, containing the Common English Cuckoo, and of the genus *Hierococcyx*, which con-

> tains the Brain Fever Bird, are very hawk-like in their barred and banded plumage.'

Our Indian parasitic Cuckoos are divided into eight genera, and, including one bird peculiar to Ceylon and another a rare straggler into Burma, number 23 species, with 17 of which we will proceed to deal with the expert guidance of Mr. Stuart Baker and his allied ornithologists.

With Mr. Stuart Baker's series of articles (xvii, 72, 351, 678, 876) will be found excellent coloured plates illustrating the eggs of all these species, also of the koel.

Since the series of articles referred to was published in 1907 the Indian forms of the Common Cuckoo (*Cuculus canorus*) has been separated into two races, the Asiatic Cuckoo (*C. canorus telephonus*) and the Khasia Hills Cuckoo (*C. canorus bakeri*); but as this separation was not effected at the time it is best to bracket them in this paper.

(1) Neither of the two races can be distinguished by the casual person in voice or appearance from the European bird. So widely distributed is this familiar bird that it is to be heard in the same month of May (here I write also from personal observation) amid the melting snows of the Himalaya (Kashmir, Kishtwar, Kunawar) up to an elevation of 11,000 ft., in the sweltering jungles of the Central Provinces and Hyderabad, in several parts of Burma, also in South India; and its distribution includes Ceylon.

Within our limits 'it breeds throughout the Himalayas and sub-Himalayas, the Hilly forest country of Chota-Nagpur and the Nilgiris, the plains of Assam at the foot of the Hills, and the Burmese Hills. Having been heard to call in the breeding season in the Hills of the Central Provinces no doubt it breeds there also.' For Shan Hills, Burma, also see Livesey, xxxvi, 997, where 'the resemblance of the eggs to those of the principal foster-parent is most marked'; also 14 blue eggs were found: and B. B. Osmaston, xxiv, 359, and Mackenzie, xxv, 742.

A blue egg is not common, and for long it was doubtful if a blue egg is ever laid. As Mr. Stuart Baker emphasises, *no cuckoo egg is beyond doubt unless taken from the oviduct of the bird.* A blue egg was obtained in this way in 1907 by Major H. A. F. Magrath in the Thandiani Hill (40 miles from Murree in the Punjab) and he was of opinion that *canorus* mostly lays blue eggs on that hill.

The tropical laid egg of *canorus* appears to be larger than that of the European bird and averages .91 in. × .67 in., the largest obtained being 1.04 in. × .75 in.

(2) THE HIMALAYAN CUCKOO (*C. saturatus*) is the next bird. One observer has witnessed the feeding of young birds of this cuckoo by its own parent or some other bird of the same species.

'The cry is a pleasant musical call; a four-syllable one of four deep whistles or hoots, very much like that of the hoopoe but rather higher in tone: and there is a preliminary high note, not easy to hear unless quite close.'

'The egg is typically elliptical, very smooth and fine grain, pure white, minutely speckled and dotted with black or dark brown.' Illustrated in Pl. I, opp. p. 72 and averages .85 in. × .55 in.

(3) The Small Cuckoo (*C. poliocephalus*) extends during the breeding season from the Himalayas to Assam, and thence easterly through North Central China to Japan; also Malay Peninsula, Java, and Borneo. B. B. Osmaston records it in Burma (xxiv, 360). 'In the cold weather it may be found practically anywhere in India and Ceylon, and more than probable, as time goes on, it will be found breeding in the Southern Hill ranges as well as the sub-Himalayas.'

'Its call is a disyllabic note twice repeated, but it has a variety of notes and is rather a noisy bird, and, though some of its notes are more or less musical, others are quite the reverse.'

Two types of egg are illustrated in Pl. I. One is 'nearly uniform pale pinkish-chocolate' the other 'pure white and glossless'. The eggs are like those of *saturatus*, average size .83 in. × .58 in.

(4) The Indian Cuckoo (*C. micropterus*) is familiar to all as the Broken Pekoe Bird whose cry has been variously rendered, 'Make-more Pekoe', 'Bo-kata-ko' (Bengali), 'Naflang-kaiko' (Cachari, 'who-stole-the-fish'), 'Kaphul-pakka', and by the British soldier 'Lost-my-rifle'.

This cuckoo 'has been found practically everywhere in India, except the driest portions of the North-West, and it doubtless breeds more or less over the whole of its habitat, ascending higher up during the breeding season and migrating locally at this time from places where there are no suitable forests or hills. It extends right away through Burma into Malaya, and again through Northern Burma into Central Asia, Siberia, China, and Japan.'

As instancing how difficult is the oology of cuckoos, Mr. Stuart Baker has to record (xvii, 884) 'No oviduct egg has as yet (1907) been got of this bird, but all the evidence obtainable confirms Colonel Rattray's identification of this bird's eggs.'

The egg is '*in all probability* pale blue, rarely faintly marked. Fine silky texture. Shape broad oval.' Four specimens are illustrated in Pl. II, opp. p. 364, average size .92 in. × .70 in.

The next genus of the sub-family *Cuculinae* is *Hierococcyx*, of which there are five species, the difference consisting in the comparative lengths of the inner wing quills. Of the five, two are common in India and known to all as the Brain Fever Birds.

(5) The Large Hawk Cuckoo (*H. sparveroides*) is not the true Brain Fever Bird, rendering pride of place in that respect to the next following songster.

Its voice is not unlike that of the koel, but is less harsh and penetrating, and can be construed *pi-pee-ah*, *pi-pee-ah*, with emphasis on the second syllable, in ascending scale. It is noisy during moonlight nights, and a torment to would-be sleepers.

Distribution is 'throughout the Himalaya as far West as Chumba, ascending in summer to elevations of 9,000 ft. or more: probably scattered here and there over the better wooded parts of the Indian Peninsula in the cold season, but only recorded from Raipur in the Central Provinces. Common on the Nilgiris in South India, but not observed in the Palnis, the Travancore Ranges, nor the Ceylon Hills. To the eastward this cuckoo is found throughout the hills south of Assam and Burma, ranging to China, Japan, the Philippines, the Malay Peninsula and Borneo.'

It is parasitic on Laughing Thrushes, Babblers, and other birds. For a long time Colonel Rattray was the only man who had taken an absolutely authentic egg of this cuckoo; but in 1906 Mr. Stuart Baker was fortunate in obtaining four blue eggs. Mr. A. E. Osmaston (xxi, 1330) contributes an article on the oology of this bird. The eggs taken by him are large: average size 1.13 in. × .82 in.

The egg is 'pale blue, long oval, stout, hard texture, glossy and not very fine. *Possibly* also chocolate-brown.' Illustration in Pl. II, average size .97 in. × .73 in.

(6) THE COMMON HAWK CUCKOO (*H. varius*). Now we meet the *true* 'Brain Fever Bird' beloved of all sick Europeans in India, though the Koel and the Large Hawk Cuckoo are often so called locally, especially where the Common Hawk Cuckoo is absent.

Its note is the same *pi-pee-ah, pi-pee-ah,* as that of *sparveroides;* but it is even more shrill and penetrating, and the bird itself even more persistent. Night or day seems much the same to it, and when the nights are very dark it awakes with the dawn and has double the energy to expend on destroying the rest of everyone within hearing.'

'It is found all over India and Ceylon, being a resident, though perhaps locally migrating, throughout its range.'

The egg is illustrated in Pl. II. 'Blue, texture like satin. Shape elliptical or spheroidal.' Average size 1 in. × .75 in. Mr. B. B. Osmaston records (xxviii, 453) that it breeds around Pachmarhi in the Central Provinces.

(7) HODGSON'S HAWK CUCKOO (*H. nisicolor*) 'is a bird of the north-eastern portion of India only, being found east from Nepal through the Himalaya and the adjoining plains of Assam, Cachar and Sylhet, through Manipur and Burma to the extreme south where it meets the similar form called *fugax* (the fourth species of this genus) which may be known by its larger bill.'

'Its ordinary note is a rather shrill copy of that of *sparveroides* and *varius*, but it is not incessantly repeated, and does not ascend and descend in scale as does the cry of both those birds.'

'It is very wild and shy.'

'The only absolutely authentic egg of this species taken as yet (1907) is the one which Mandelli took from the oviduct of a female on the 5th June. The colour is a uniform olive-brown or olive green, sometimes marked with reddish. Texture fine and silky. Shape elliptical. It measures .89 in. × .64 in. and is illustrated in Pl. II.

(8) THE SMALL HAWK CUCKOO (*H. nanus*) is the fifth of this genus. 'Nothing is known so far of the oology of this cuckoo. It is a bird very little known: indeed it is possible that even now we do not know its adult plumage. It has only entered the limits of the Indian Empire in the extreme south of Burma and Tenasserim, and it is also known from Selangor and North Borneo.'

The genus *Cacomantis* contains, as far as India is concerned, two species of cuckoo, much like, in general appearance, the genus *Cuculus*, but very small, the wing measuring under 5 in., whereas none of the birds hitherto dealt with have wings as small as 5½ in.

(9) THE INDIAN PLAINTIVE CUCKOO (*Cacomantis merulinus passerinus*) ranges through the greater part of India, from the Himalaya to Ceylon inclusive, rare in the North-West, and although found on Mount Abu, wanting elsewhere throughout Rajputana and the Indus plains. It occurs in the Himalaya from Simla to Sikhim, ascending the hills to the westwards up to about 9,000 ft. according to Jerdon, and its range extends to Eastern Bengal where it meets the next species. In the Peninsula of India it is chiefly found in forest regions, and is most abundant in Bengal, Orissa, the wooded tracts of the latter, and on the hills in the neighbourhood of the Malabar coast (Blanford).' It is recorded from Abbottabad (xxiv, 595).

Its call is a plaintive *we-whew, we-whew*, and it is noisy in the breeding season, being much heard on moonlight nights. It is a shy bird.

It was Miss Cockburn who established the identity of the egg, which is illustrated in Pl. II in two colours, blue and speckled white. Size (average) being .72 in. × .52 in. In his Additional Cuckoo Notes (xvii, 885 et seq.) Mr. Stuart Baker adds much to the oology of this bird. There appear to be several types of egg. The bird is parasitic chiefly on the Tailor Bird, also on the Ashy Wren Warbler, the Small Minivet and others. In these same Notes Professor Burnett of Hyderabad contributes much interesting matter. Also B. B. Osmaston in xxiv, 361-2.

At xvii, 371, it is recorded that the eggs of this cuckoo were found in the nests of a babbler and a shrike. 'This is curious as the eggs of both these birds are much larger than those of the cuckoo, and it is an almost invariable rule for cuckoos to choose birds which lay eggs smaller than they do or, at least, as small.'

(10) THE RUFOUS BELLIED CUCKOO (*C. m. querulus*) is the Eastern representative of the Plaintive Cuckoo and is found all over Eastern Bengal, Assam and Burma. It is resident in all these provinces, and is very common. In habits etc. it is like the Plaintive Cuckoo and its voice resembles that of that bird, but is less seldom used, and perhaps less high pitched and shrill.

Information as to its breeding is scanty and very conflicting. The egg is *possibly* like large eggs of the Indian Wren Warbler and of the Indian Tailor Bird. The greenish egg with large blotches, believed to be that of this bird, is illustrated in Pl. III opp. p. 680 of xvii.

Of the genus *Penthoceryx* we have three species, of which one is of Ceylon only and another peculiar to Malay and the East.

(11) THE BANDED BAY CUCKOO (*Penthoceryx sonneratii sonneratii*) is common in Ceylon and the south of India, but becomes much more rare further north, especially to the west. It extends through Bengal to Assam and so through Burma, Malay Peninsula, Sumatra, Borneo and Java.

The egg has been seldom obtained. In 1907 Mr. J. Davidson had the only oviduct egg of this species in existence. The egg illustrated in Pl. III was supplied by Mr. Davidson and said by him to closely resemble the oviduct egg. Colour brownish-pink ground, speckled and freckled with reddish brown, texture and shape as in *canorus*. Average size .76 in. × .63 in.

The bird has two distinct cries—one exactly like that of the Indian Cuckoo (No. 4 *ante*) except in a much higher key; the other like that of the Indian Plaintive Cuckoo except that it *always* stops in the middle of the second or third repetition.

Of the genus *Chalcococcyx* there are three within our limits but one of these, the Malay Violet Cuckoo, need not be considered in this paper.

(12) THE VIOLET CUCKOO (*Chalcococcyx xanthorynchus xanthorynchus*) is confined to the east of the Empire and found throughout Assam, especially Cachar and Dibrugarh, the whole of Burma and Malay Peninsula, Sumatra, Borneo, Java, Andamans, Nicobars.

There is practically nothing on record about its habits, voice, etc. The bird is not very shy, but keeps much to the tops of lofty trees on high ground. They are very fond of haunting the tops of lofty silk cotton trees (*Bombax*) when in flower; and in this are in company with a number of other species of birds, also squirrels, monkeys, and countless insects.

The male of the species has the upper parts glossed with metallic violet. The female is parasitic on the Nepal Babbler, and doubtless other small birds of that type.

The eggs are probably much like those of the Banded Bay Cuckoo but with general tone far more pink and less brown. 'The eggs are very large *for cuckoo's eggs*, in proportion to the size of the bird, the bulk being as much as it is in the eggs of *poliocephalus* (3) and *saturatus* (2) birds of, perhaps, between three and four times the cubic contents of the tiny Emerald Cuckoo. The eggs of both species are illustrated in Pl. III. Size .75 in. × .56 in. to .78 in. × .63 in.

(13) THE EMERALD CUCKOO (*C. maculatus*) has the upper parts glossed with metallic green and has much the same range as the former bird, but it extends further west, having been recorded as far as Kumaon. It also straggles into Eastern Bengal. 'This cuckoo has a comparatively large foot, hence its activity when in trees.'

Both the species are parasitic on Babblers, and of course on other species also. Reference should also be made to Stuart Baker, xviii, 275 and 915; and Inglis, xviii, 681.

Now we meet a very remarkable bird, to be found if diligently sought for but very seldom recognized. This is the Drongo Cuckoo (*Surniculus*) of which we have three species of the genus; the Malay, the Indian, and the Ceylon.

The two latter divide India between them, the habitat of the first being Upper India, Assam, Burma, Siam, Hainan, China; and of the second Ceylon, Travancore and the West Coast up to Karwar.

(14) THE INDIAN DRONGO CUCKOO (*Surniculus lugubris dicruroides*) may be considered with the Ceylon Drongo Cuckoo (*S. l. stewarti*) as they are no doubt very similar in size, habits, and appearance, having been only of recent years distinguished the one from the other.

Of this bird Mr. Stuart Baker writes (xvii, 687) in 1907: 'There is nothing absolutely authentic on record about this Cuckoo's eggs' and 'so close is its resemblance to the Common Black Drongo that it escapes observation', 'its flight is varied, sometimes dipping much as it is with the King Crows, at others quick and direct. Its call is a most human whistle of six notes running up in scale, and this it gives frequent utterance to both by day and on moonlight nights. I have also heard one utter a double plaintive note like *whee-whip*, much like a call indulged in by the King Crow in the breeding season. Indeed, had I not been standing close under the cuckoo as it was in the act of calling, I should have thought it was the Drongo.'

The King Crow, a masterful champion, valiant and ever vigilant, is one of the best known birds in India; for who does not know the black, fork-tailed bullies which sit on the telegraph wires and make graceful sallies into the air after the flies and insects on which they feed?

Let us consult Mr. Douglas Dewar in 'Bombay Ducks'. 'Why the King Crow? Needless to state, this royal bird has no connexion with the vulgar, plebeian crow.' . . . 'Far more appropriate is one of the native names for the bird, the Kotwal; which, being interpreted, is the head officer of the chief police station. Everyone who is acquainted on the one hand with the methods of the Indian police, and on the other, with the habits of the King Crow, will appreciate the title—he takes upon himself the burden of keeping in order the whole bird population of India. His office is no sinecure, for although the fowls of the air are in general law-abiding folk, there are not wanting among them vagabonds, egg-stealers, nest-breakers, and other criminals' and much more that is most entertaining and instructive, so you really should possess the book referred to by this author, who is also a notable contributor to our *Journal*.

As to our Drongo Cuckoo he writes in the same book, '*Surniculus lugubris* is, perhaps the most wonderful example of mimicry in nature. It has adopted the dress of the Drongo (also his voice and flight). It is black all over and has a forked tail. It is said to be a very uncommon cuckoo. I do not know if I have ever seen a live species or not, for I cannot distinguish it from a King Crow. I am not ashamed of this admission: for the King Crow is in this respect no better off than I am. I submit that if A cannot distinguish B from his (A's) own brother, it is surely not to be expected that I, a stranger can do so!'

In xxiv, 362, Mr. B. B. Osmaston describes the call of this bird around Maymyo, Burma; also xxiv, 595, may be referred to, where the call is described as mistaken for the whistling of a boy.

The reader can therefore well realize that, in almost whatever part of this country he may be, he has here something worth while investigating during his leisure hours. This cuckoo differs from his dupe in that he has 'a few white spots and patches which are hardly noticeable unless the bird is extremely close'.

There are two Crested Cuckoos, the Pied Crested Cuckoo (*Clamator jacobinus*) and the Red-winged Crested Cuckoo (*C. coromandus*).

(15) THE PIED CRESTED CUCKOO (*C. jacobinus*) is found 'practically throughout India and Burma, its eastern boundary being the Irrawaddy river. It does not extend further south in Burma than Upper Pegu, but is common in Ceylon. Outside India it is obtained throughout Southern and Central Africa.'

'Its flight is slow but fairly direct. It haunts indifferently the loftiest of trees, secondary growth and small saplings, or mere scrub jungle. (Often it can be seen jumping in the grass while catching insects.) Its call is a very loud metallic double note, too harsh to be called a whistle. In the early part of the season, before its voice has fully formed, its cries are particularly harsh and disagreeable, and the second note, which should be the same in tone as the first, often goes off at a tangent. Later in the year, though it becomes more noisy than ever, its notes are rather musical.'

In xxxiii, 136-44, will be found an article, with explanatory map, by Mr. Hugh Whistler setting out all that was then (1928-29) known as to the migration of this bird: and asking observers to take notes and report results: the point at issue being whether the Pied Crested Cuckoos which are rains visitors to a huge area in India, winter in Africa. The sole response appears to have been the contribution of Mr. Salim A. Ali, xxxiv, 1071.

This cuckoo is largely parasitic on Bulbuls, also on Laughing Thrushes. An observer saw a Pied Crested Cuckoo deposit its own egg in the nest of a Jungle Babbler and remove one of the Babbler's eggs (xxvii, 894). Two eggs were taken from the nest of the Nepal Babbler, 'the huge Blue Cuckoo's eggs in the tiny nests of *Alcippe* looked very ridiculous, and it seems incredible that the birds could have been so imposed upon as to be induced to hatch them.'

The eggs are well known. 'Dark blue-green. Texture extremely fine and silky, surface smooth. Shape broad, elliptical' and are illustrated in Pl. III. Size, average, .94 in. × .80 in.

(16) THE RED-WINGED CRESTED CUCKOO (*C. coromandus*) appears to be a rare bird in India, but with that proviso and other limitations, its habitat seems to be that of the other species. It is common around Maymyo, Burma, and there is a whole page concerning its eggs, food habits, and voice by Mr. B. B. Osmaston in xxiv, 361.

On the morning of the 7th November 1900 a cuckoo of this species 'was caught in the Society's Museum where it had no doubt sought shelter from the unwelcome attention of the crows, which are even quicker than the Members of the Natural History Society to notice a stranger in the neighbourhood.' Only once previously had this species been recorded from any part of the

Bombay Presidency. That bird was obtained at Savantwadi, and is also in the Society's collection.

The eggs are known. Pale blue-green. Texture as for *jacobinus.* Shape spheroidal. Illustration in Pl. III. Average size 1.06 in. × .90 in.

All the sub-family *Cuculinae* have now been dealt with. The next sub-family is *Phoenicophainae* of which there are 8 genera comprising 21 species. Only the first genus, *Eudynamis*, is parasitic. The others include the Malkohas (9 species), the Sirkeer Cuckoos (3 species) and the Crow Pheasants (7 species).

The Malkohas are green-plumaged birds some of which have red bills and some green bills. Being mostly forest birds they do not attract notice. The Small Green Malkoha is common in South India, while the Large Green-billed Malkoha takes its place in the north-east of India, Bengal and Assam.

Of the Sirkeer Cuckoo, an uncommon and peculiar bird, very little is recorded in the *Journal.* Mr. E. H. Gill (xxix, 299) describes the curious courtship lasting about twenty minutes, when the male bird makes the most of the patchwork effect of his sober plumage.

The Crow Pheasant whose 'deep, sonorous *whoot, whoot, whoot* is one of the most familiar of the sounds which greet the rising sun in India' is well known to almost everyone. Its food is mostly insectivorous but it is said to eat the eggs of other birds; and in localities where there is preservation of game a price is placed on its head. This is probably without proper justification, and the bird may do more good than harm.

(17) THE INDIAN KOEL (*Eudynamis scolopaceus scolopaceus*) 'ranges throughout India, Ceylon and Burma, and is unpleasantly common anywhere but in Sind, where it is very rare, and in the West Punjab where it is uncommon. It ascends the Hills up to about 2,500 ft., above which it ceases to persecute. Outside India it extends to Western China, throughout the Malay Archipelago, the Andamans, Laccadives and Flores.'

'Its most common cries are *ko-il*, generally turned into *youre-ill* by Europeans, and continuous shouts of *who-are-you.* By some people this bird has been called the Indian Nightingale (these have probably lived in Sind), and by others its music has been called 'An Introductory Poem to Hades'. It is *always* noisy, but more particularly so by night when it is moonlight. It is everywhere pushing and forward, but, perhaps, more especially so in the compounds of houses containing sick persons.'

The Emperor Baber styled the Koel 'The Nightingale of Hindustan'.

'Its breeding season lasts from the end of April to the end of August. In March it practises its voice and gets its throat into working order, and in September its voice breaks, gradually ceases, and the world has rest for a few cold weather months.'

In India the Koel is mainly parasitic on the Common Crow, and on the Burmese Crow in that country. Occasionally the Jungle Crow is made use of, and its egg has been found in the nest of the Magpie in Burma, and in that of the Common Myna in Dibrugarh (Inglis, xviii, 682) and in one peculiar case in that of the Oriole—a very small nest—but that was no doubt a case of emergency (D'Abreu, xxxi, 1032).

A very full and amusing account of the Koel will be found in Mr. Douglas Dewar's 'Birds of the Plains', also in his 'Bombay Ducks' where male and female are illustrated: and in xvii, 765-82, is his very full 'Enquiry into the Parasitic Habits of the Indian Koel' in which he concludes that the young Koel does not eject the crow's eggs or his fellow nestlings—other than by accident; that the incubation period of the Koel's egg is slightly shorter than that of the crow; that the koel undoubtedly destroys, or tries to destroy, some of the crow's eggs it finds in the nest, and given opportunity will destroy all the crow's eggs; that the destruction does not necessarily take place at the same time the koel's egg is laid; that there is no hollow in the back of the koel nestling; that the koel will frequently lay her egg in the crow's nest; and other matters of kindred interest.

His accounts of how he 'played cuckoo' are highly interesting and amusing, and illustrate that 'a nesting bird seems to cast intelligence to the winds. The crows sat upon, and hatched, a fowl's egg, upon a sea-green paddy-bird's egg, and on a golf ball, apparently without noticing that these differed in any way from their own eggs. Again, the addition or subtraction of an egg or two was not noticed. Further, when I introduced a young koel into a nest containing eggs only, the parent birds at once set to work to feed the young koel as though they were quite accustomed to young birds being thus introduced into the nest!' Experiments of others in the same direction are also cited.

In vol. xxiv, 595, Mr. Hugh Whistler also contributes as to incubation and removal of crow's eggs at time of laying.

Mr. Salim A. Ali, an accurate observer who contributes valuable articles to our *Journal*, also (xxxiv, 1067) 'played cuckoo' with regard to egg mimicry of *canorus* and one of his experiments was cut short by a female koel which swallowed all the four eggs in the nest in as many seconds!

Ordinarily not more than two koel's eggs are found in a crow's nest, but on occasion four or more are found; and in one instance (xxxv, 458) eleven eggs are recorded. These are cases of two or more birds depositing their eggs in the same nest; and this can be known by the different types of egg found in such cases: but Mr. Dewar says (xvii, 782) that a great deal of variation is displayed in the same clutch. 'In one clutch of four eggs each differed so greatly from the others that, unless I had myself taken all four eggs out of the same nest, I should not have believed that one bird could have laid them.' Can it have been that more than one bird laid those eggs?

With the exception of examination (for purposes of 'distribution') of the many lists of birds from various localities in the Indian Empire which have been contributed from time to time by Members of the Society, I have carefully searched the past fifty years of the *Journal* for material, and think that nothing of importance has been omitted in this effort to bring 'Cuckoo-

Lore' up to date for the information and entertainment of readers.

Editor's Note.—The cost of back numbers of the *Journal* has been greatly reduced; so those referred to in this article, vol. xvii, Nos. 1-4 (which contain the egg Plates), and most of the others, can be obtained at one rupee each.

In connection with the study of Ornithology the Editors invite attention to the several series which have appeared in recent years in the *Journal* of the Society such as: The Study of Indian Birds by Mr. Hugh Whistler; and The Birds of Prey of the Punjab by Mr. C. H. Donald.

THE ORNITHOLOGY OF TRAVANCORE AND COCHIN.

BY

Sālim Ali.

With Notes by Hugh Whistler.

Part III.

(*With two plates*).

(*Continued from page* 92 *of this volume*).

Family: Turdidæ.

Brachypteryx major albiventris (Blanford). The White-bellied Shortwing.

Specimens collected: 115 [♂] imm. 20-1-33 Mūnnār 5,000 ft.

Elsewhere not noted. Possibly overlooked or confused with *Muscicapula pallipes*.

In the Trivandrum Museum I have seen the following Travancore skins: o? 5-3-03 Chemunji; o? 5-97 Devikolam. William Davison obtained four specimens 'in late December or early January on the Chimpani Hills dividing Travancore territory from Tinnevelly District.' (*Ibis*, 1888, pp. 146-47.)

Colours of bare parts: Iris bright khaki brown; bill brownish-black; mouth pale pinkish-grey; legs, feet and claws horny-brown.

[I have examined the following specimens in the British Museum Collection: o? 18-4-77, o? 16-4-80 Colathoorpolay, Patnas 3,800 ft. and 4,000 ft. (Bourdillon); ♀ ?-5-97 Devikolam (A. H. Nair); ♀ 16-4-79 Mynall 4,000 ft. (Bourdillon); ♀ 11-6-77, ♀ 21-6-77, ♂ 23-6-77 Kodaikanal 7,000 ft., Pālnis (Fairbank); ♂ *Type* Pālnis (Fairbank); ♂ 24-5-77 Pillar Rocks Grove 7,000 ft., Pālnis (Fairbank). No material is available for plumage study.—H. W.]

The specimen—a young bird with very imperfectly ossified skull—was shot on a densely scrubbed hillside on the town outskirts in the same biotope as *Tarsiger brunnea, Ochromela nigrorufa* and *Pitta brachyura*. It was solitary.

According to Ferguson the White-bellied Shortwing is found throughout the Travancore hills in dense forest undergrowth at elevations over 3,000 ft.

In the Palni Hills, Fairbank (*S.F.*, v, 402) writes: 'I obtained one pair in 1867 with their nest and two eggs all in the Kodai Grove. Described by Blanford in *P.Z.S.* and figured in Gould's *Birds of Asia*. I found them in the same locality again in May and June this year. They live in the thickets of the Kodaikanal and I obtained one in another grove at the Pillar Rocks. As May is their nesting season and they indulge in a sweet song in the evening twilight it is not difficult to trace them, though it is difficult to see them far enough away to shoot without spoiling them. Sometimes they come out of the thickets at dusk and sit by a bank or on the roadside and sing. Their song is not so loud or so varied as that of *Merula simillima*, but similar in style and in the quality of its tone.'

This bird is not found in Ceylon.

Breeding: Terry (*S.F.*, x, 473) also met with it in the big shola [Vembadi?] at Kodaikanal. He took c/2 fresh eggs on 7 June and c/2 fresh 'later', and gives a description of the nests.

From the accounts it appears that April, May and June are the breeding months in the Pālnis. Unless they also breed considerably later in Travancore, it is difficult to account for the Survey specimen having a 'very soft skull' as late as the 3rd week of January. In plumage, however, this specimen is indistinguishable from the adult. The only clutch from this area in Mr. Stuart Baker's collection was taken by T. F. Bourdillon on 7 March (*Nidification*, ii, 4).

Tarsiger brunnea brunnea (Hodgson). The Indian Blue Chat.

Specimens collected: 109 ♂ 18-1-33, 116 ♀ imm. 20-1-33 Mūnnār 5,000 ft.; 379 ♂ 28-2-33 Kūmili 3,000 ft.; 972 ♂ imm. 13-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Sānthanpāra (3,500 ft.); Peermade (3,200 ft.); Camp Derāmalāi (3,000 ft.); Balamore Estate (2,000 ft.—25 and 26 April !).

Colours of bare parts: Iris dark brown; bill blackish-brown, gape and chin pale brownish flesh colour; mouth greyish-pink; legs, feet and claws brownish flesh colour.

[The Survey specimens measure:

	Bill.[1]	Wing.	Tail.
3 ♂♂	15	74-78	46-51 mm.
1 ♀	15.5	73	46.5 mm.

Other specimens examined:

B. M. Collection: ♂ 19-11-74, ♀ 19-1-75 Mynall, Travancore (Bourdillon).

The plumages of this species are as follows:

Juvenile male: The whole upper plumage including sides of the head and the lesser and median coverts dark olive-brown, the feathers faintly mottled with dark brown and fulvous; remainder of wings and tail as in the adult male but duller, the greater coverts edged with fulvous; whole lower plumage fulvous, becoming albescent on the centre of the abdomen and vent, the feathers edged with dark brown, lightly on the chin, throat and undertail coverts, very heavily on the breast and flanks.

Juvenile female resembles the juvenile male except that the upper tail coverts are washed with rufous and the wings and tail are similar to those of the adult female.

The post-juvenal moult is complete with the exception of the primary and outer greater coverts, the primaries, secondaries and tertiaries and probably the tail which are retained till the following autumn. It presumably takes place about August-September.

The first winter plumage of the male has two phases which may be considered in the light of 'retarded' and 'progressive' plumages as recently discussed by Mayr (*Amer. Mus. Novitates,* No. 666, 7 October 1933). The more complete or 'progressive' phase is exactly like the adult male plumage, save for the unmoulted portions of the juvenile plumage. The other phase is very different in that the forehead and lores are fulvous, the top of the head, hindneck and upper mantle are brown with a fulvous and blue-grey wash; the white supercilium and black facial band are absent, being replaced by mixed brown and fulvous. The chestnut of the lower parts is paler, becoming whitish on the chin and throat. This phase would I suppose be considered as 'retarded' by Mr. Mayr. At the same time it must be remembered that it may equally be regarded as a step towards the formation of a definite first-year plumage quite distinct from the juvenile and adult plumages. Whether males in this second phase would breed it is not fully clear. They would presumably do so as the birds of the 'progressive' phase certainly breed in it without the interposition of a spring moult. If, however, the species is slowly developing a third or pre-adult plumage as suggested, it may well also be developing a spring moult to ensure that the fully adult plumage is assumed for the breeding season.

The adults have a complete post-nuptial moult about August and September. There is no spring moult and the summer and winter plumages are alike.—H. W.]

The Indian Blue Chat is a fairly common winter visitor to all the Travancore and Cochin hills. I met it between 2,000 and 5,000 ft. elevation, the last date being 26 April. It may, however, be found somewhat later than this, and a specimen in the Trivandrum Museum obtained by Ferguson (and referred to in his notes *J.B.N.H.S.*, xv, 261) is labelled: ♂ May 1891 High Range. By the end of April most birds had left.

These chats frequent evergreen undergrowth, preferably of seedlings, but I also found them partial to *Rubus* and *Pandanus* thickets especially where lining forest nullahs or hill ravines. They were commonly met with under coffee bushes and cardamom plants. They are usually found singly, flitting about the undergrowth, alighting on the ground and hopping along easily and swiftly in search of insects. A feeble monosyllabic squeak is repeated about once a second, usually punctuated at intervals by 'chr-r-r' or 'chick-chick' like *Alseonax.* The bird similarly jerks its tail up when uttering these sounds.

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[1] All bill measurements are from skull unless specified.

Kinloch considered the Blue Chat somewhat rare in the Nelliampathies. Fairbank (*S.F.,* v) does not record it in his Pālnis list and the species has apparently not yet been met in those hills.

It is a winter visitor also to the Ceylon hills being found there from the middle of October to April.

Specimens No. 972 (13 December) and 116 (20 January) were immature with imperfectly ossified skulls. The *Fauna* (ii, 14) gives the breeding season from Kashmir to Sikkim as May, June and early July. Unless, therefore some birds also breed considerably later, it would seem that the process of ossification is unusually retarded in this species.

Saxicola caprata atrata Blyth. The South Indian Stone-Chat.

Specimens collected: 74 ♀ 12-1-33 Marāiyūr 3,500 ft.; 110 ♂ 18-1-33 Mūnnār 5,000 ft.; 150 ♂ 25-1-33 Sānthanpāra 3,500 ft.; 331 ♂, 332 ♀ 28-2-33 Peermade 3,200 ft.

Elsewhere noted at: Camp Derāmalāi (3,000 ft.); Wadakkāncheri (400 ft.) doubtful!

Noted as absent at Thattākād (200 ft.) and Kūmili (? 3,000 ft.).

Colours of bare parts: Iris brown; bill, legs, feet and claws brownish-black; mouth yellowish-pink, greyish-pink or brownish-pink presumably varying with age.

[Additional specimens examined:

B.M. Coll.: ♂ -2-80 Peermade (Bourdillon); 2 ♂♂ (Fry); 2 ♂♂ June, Kodaikanal, Pālnis (Fairbank).

Sparrow Coll.: ♂ 21-3-14 Cardamom Hills (Sparrow).

B.N.H.S. Coll.: ♂ 25-5-93, ♂ 4-3-94 Kodaikanal (Cook); ♂ 3-12-00 Pambanam; ♂ 28-12-00 Stagbrook; ♀ 1-1-01 no locality; ♀ 25-1-01 Devicolum.

Measurements:

	Bill.	Wing.	Tail.
13 ♂♂	14.5-18	72-78.5	53-59.5 mm.
4 ♀♀	15-16.5	70-75.5	51-54 mm.

In the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, 69) I admitted the race *S. c. burmanica* with a good deal of hesitation, the difference between it and the typical race ((Luzon) being merely one of measurements and that very limited. Since then I have been enabled to examine extra specimens including series from Khandala and the Biligirirangan Hills through the kindness of Mr. Humayun Abdulali and Mr. Ralph Morris respectively. These series show that there is complete intergrading between the large *atrata* of the S.-W. hill ranges and the small *burmanica* type obtained in the Eastern Ghats, which destroys the very small margin which I showed to exist between the Eastern Ghats series and the typical series. Dr. Ticehurst also informs me that a series received by him from Burma also shows that Burmese birds cannot be separated from the typical race. To sum up the effect of the specimens now measured by me (excluding the Biligirirangan series which on the whole are closer to *atrata*):

	Bill.	Wing.
17 ♂♂ (E. Ghāts, Hyderābād, Nāgpūr, Malabar Coast)	13.5-15	67-76.5 mm.
19 ♂♂ (Burma)	13.5-15	66-73 mm.
11 ♂♂ (Luzon, Timor, Lombock etc.)	14-15	64-75 mm.

On these measurements there is obviously no room to recognise two races, even though it be admitted that if individual specimens are examined the Luzon series tend to average larger in the same proportion as Ceylon birds

1. Shifting Camp across Periyār Lake, ca. 3,000 ft.

(Undulating grassy hilltops in background, favourite haunt of *Schoenicola*. Partially submerged dead tree-trunks provide nesting sites to Mynahs of several species and foraging bases to *Artamus fuscus, Phalacrocorax, Haliastur* and other birds.)

Photos by author.

2. A friendly visitor to the collecting camp at Arāmboli. The Indian Robin (*Saxicoloides f. fulicata*) ♀.

compared with those of the Nilgiris. These average differences are not worth subspecific recognition. The new specimens now available further confirm that the females of both *atrata* and *caprata* are considerably darker than females of the northern *bicolor* and more heavily streaked on the underparts.

The juvenile plumage of *atrata* is much darker than that of *bicolor*. Compared with the latter the upper parts are a darker sooty-brown, with the pale spotting much reduced; the chin and throat are dark sooty-brown with pale central spots. The white spot on the inner coverts is much enlarged.

The adult plumage is assumed at the post-juvenal moult with the exception of the primaries and their coverts, the secondaries and outer greater coverts and tail, which are retained from the juvenile plumage apparently to the following autumn. In this first winter plumage the black body feathers may be largely fringed with brown. There is no pre-nuptial moult and the complete post-nuptial moult starts as early as May and June.—H. W.]

The Stone-chat or Pied Bush-chat is not an abundant species in the Travancore-Cochin area. It is mostly confined to the hills where I came across it up to 6,500 ft. elevation (Kūmarikkāi Malāi, above Marāiyūr). Of all the localities it was perhaps commonest at Mūnnār (5,000 ft.) with Peermade a good second, though even here its numbers could stand no comparison with its abundance in the Nilgiris. Camp Derāmalāi was the southernmost point at which the species was noted.

The birds frequent open grassy hillsides sparsely interspersed with dwarf date palms or straggly Nelli (*Phyllanthus emblica*) trees, and usually keep in pairs.

On the Pālni Hills, Terry (*S.F.*, x, 476) considered it one of the commonest birds and he took several nests there.

In Ceyon this chat is a resident species, but local and restricted to elevations above 3,500 ft.

Breeding: In specimen No. 110 (18 January) the testes had commenced developing and measured ca. 3×2 mm. Males at this time were singing from exposed perches, a behaviour indicative of the approach of the breeding season. The gonads of a pair, Nos. 331 and 332, on 22 February showed that they were ready to breed: the testes measured 6×4 mm. while the ovarian follicles were about 1 mm. in diameter.

The above confirms the statement in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, 70) that the breeding season in this area commences as early as February. It is said to continue till the end of May, but that most nests contain fresh eggs about the end of March and the beginning of April.

Cyanosylvia svecia (Linnaeus) subspecies? The Bluethroat.

Specimens not obtained.

At Thattākād (200 ft.) I saw the Bluethroat on several occasions in among water-logged paddy fields amidst forest. A specimen shot could not be recovered. It was not abundant here, neither was it noted elsewhere in Travancore.

The species has apparently not been recorded from this area before, though Hume (*S.F.*, x, 390) states that in the Wynaad it is common.

Saxicoloides fulicata fulicata (Linn.). The Indian Black-backed Robin.

Specimens collected: 243 ♂ 8-2-23 Thattākād 200 ft.; 601 ♂ 16-4-33, 607 ♂ 17-4-33, 625 ♂ juv. 19-4-33 Arāmboli 250 ft.; 921 ♀ 29-11-33 Wadakkāncheri 400 ft.; 935 ♀ 3-12-33 Nemmāra 300 ft.; 1056 ♂, 1057 ♂, 1058 ♀, 1059 ♂ 1-11-34, 1060 ♀, 1061 ♀, 1062 ♀, 1063 ♂ 2-11-34 Perūmbāvūr 600 ft.

Elsewhere noted at: Trichūr, Karūpadanna (ca. S.L.).

Colours of bare parts: *Adult*: Iris brown, bill, legs, feet and claws brownish-black; mouth blackish-brown, slaty-pink or greyish-pink varying with age (?). *Juvenile*: Iris olive-brown; legs and feet greyish-black; claws black; mouth bright yellow.

[The only other specimen from this area seen is in the British Museum ♂ -10-69, Pālnis (Hume Collection).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
12 ♂♂	15-17	73-79	60-67	25-27 mm.
9 ♀♀	15-15.5	69.5-75	59.5-62.5	25.5-26 mm,

Juvenile plumage (♂ No. 625): Upper plumage chocolate-brown, the bases of the feathers darker, the earcoverts streaked with rufous brown; wings and their coverts dark chocolate-brown, the feathers edged with rufous brown; tail black; lower plumage dark chocolate-brown, each feather of the chin, throat and breast with a fulvous brown subterminal spot giving a mottled appearance which dies away on the abdomen; lower tail-coverts chestnut.

I am not able to make out clearly whether the post-juvenal moult is complete. In nearly all specimens the primaries and their coverts appear to be faded and contrast with the rest of the wing, but I am not satisfied whether these feathers start paler and bleach more rapidly or whether they are remains of the juvenile plumage.

There is no pre-nuptial moult and the complete post-nuptial moult normally takes place from August to October in Southern India generally.

In the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvi, 72) I remarked on the fact that the only female of this species seen from Ceylon, in the British Museum Collection, was quite different to Peninsula specimens, being very dark, almost black in colour and pointed out that if this difference was found to be constant it would necessitate a revision of names. Since then the Director of the Colombo Museum has very kindly sent me on loan a series of 7 specimens collected in Ceylon. The two females in this series agree with the British Museum specimen in colour, the single juvenile is just as dark, and the males have rather less chestnut on the vent region as compared with Peninsular birds, both sexes also having rather heavier, though not longer bills. It is evident, therefore, that Ceylon birds must be kept separate from those of the Peninsula and to them the name *fulicata* applies. For the southern peninsular race I think we may use *Œnanthe ptymatura* of Vieillot. The *Fauna* (vol. vii, p. 112) gives the type locality for this as Ceylon, making the name a true synonym of *Saxicoloides f. fulicata*, but this is not quite correct. *Œnanthe ptymatura* Vieillot, Nouv. Dict. d'Hist. Nat. xxi (1818), p.435 was based on Le Vaillant Hist. Nat. Oiseaux Afrique (1805), pl. 188, fig. 1, representing Le Traquet à queue striée. In the text it was stated 'L'espèce de ce traquet habite les buissons et les bois de mimosa du pays caffre' but there is no South African bird which can be identified with the plate. As, however, the author goes on to say that this Traquet 'se trouve aussi dans Le Bengale' and as the plate certainly agrees with the male of the Indian Robin, it is evident that this species is meant. The locality 'Bengale' cannot, however, be literally correct as Bengal birds belong to the brown-backed race and the plate most manifestly represents the black-backed form. I think therefore we are justified in regarding the word Bengal as used in the old sense as a synonym for India and restricting the type-locality to Pondicherry, then already a French possession in the south, in order to avoid the creation of a new name.

As regards our Travancore series, No. 935 is as dark as the Ceylon females and No. 1058 is nearly as dark. The other females, however, agree with South Indian birds; the males have the chestnut patch rather larger than in Ceylon birds, whilst the beak in both sexes agrees with Peninsular birds. The series is in fact exactly intermediate and its inclusion with either race is a matter of opinion. On the whole I think it is best included with the typical race.—H. W.]

The distribution of the Indian Robin in the Travancore-Cochin area is governed entirely by the presence or otherwise of dry stony country with short grass and sparse thorn and cactus bushes, such as generally obtains on the Deccan Plateau and in the Madras districts across the eastern boundary of the States. Add to this a sprinkling of *Borassus* palms standing on bunds or about dry paddy fields hedged with patches of Lantana here and there, and you have the ideal environment for this species. On a casual acquaintance Thattākād appeared a most unlikely spot to find the Robin in. A few miles down the Periyār River, however, a patch was struck which conformed with most of its requirements and here the species immediately appeared. As Ferguson observes, it is not a common bird in Travancore but I found it decidedly more so in Cochin. Wherever its ecological requirements are satisfied—chiefly in the low country—small numbers are usually to be met. Ferguson has seen it at 2,000 ft. elevation in the hills during the dry season.

Fairbank (*S.F.*, v, p. 406) records it from the eastern base of the Pālni Hills.

This Robin is a common resident in Ceylon.

Breeding: On 25 December (Karūpadanna, Cochin) a pair were observed building in a pocket in a laterite roadside cutting near the Travellers' Bungalow. Both birds were bringing building material—hair, rootlets, cocoanut fibre, etc. —more or less alternately at intervals of 30 seconds to 1½ minutes. They were most active till about 10-30 in the forenoon. The full clutch of 3 eggs was completed on 30 December. During the heat of the day the nest was mostly left unattended, but the female brooded at night. The male evidently does not share in the incubation though later he helps to feed the young.

In specimens No. 243 (8 February) and 601 (16 April) the testes measured 4×3 and 5×4 mm. respectively, while No. 607 (17 April) with testes 6×3 appeared to have a nest in the neighbourhood. No. 625 (19 April) was in juvenile plumage with imperfectly ossified skull.

The breeding season obviously commences considerably earlier in this area than has been recorded from elsewhere, and continues at least till about the middle of April, if not later.

Copsychus saularis ceylonensis Sclater. The Magpie-Robin.

Specimens collected: 31 ♀ 7-1-33 Marāiyūr 3,500 ft.; 705 ♂ 22-7-33 Trivandrum ca. 100 ft.; 759 ♂ 31-7-33 (Akkūlam 150 ft.); 768 ♂ 2-8-33 (Marūthānkūzhi ca. 50 ft.); 793 ♂ 5-8-33 (Poojappūra 150 ft.); 812 ♀ 8-8-33 (Makūnnimalai 800 ft.) Trivandrum Environs; 923 ♂ 30-11-33 Wadakkancheri 400 ft.; 1028 ♀ 27-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Thattākād (200 ft.), Kottāyam (ca. S.L.); Kūmili (3,000 ft.), Rājampāra (1,350 ft.), Tenmalāi (500 ft.); Arāmboli (250 ft.); at base of Ashāmbū Hills below Balamore Estate (ca. 500 ft.), Chālakūdi, Kūriārkūtti (1,600 ft.), Nemmāra (300 ft.), Trichūr, Ernakūlam.

Apparently it was absent at Pādagiri (3,000 ft.—Nelliampathies), Peermade (3,200 ft.) and curiously enough also at Cape Comorin.

Colours of bare parts: Iris brown; bill horny-black; mouth yellowish-flesh to slaty-pink; legs, feet and claws horny-brown.

[Five males from Travancore in the British Museum are without data. The Survey specimens measure as follows:

	Bill.	Wing.	Tail.
5 ♂♂	21-24	97.5-104	81.5-90 mm.
3 ♀♀	21-21.5	92-97	80-81 mm.

In writing on the Magpie Robin in the Eastern Ghats Survey Report, I was hampered by the fact that the British Museum possessed no females from Travancore. This has been remedied by the present Surveys and it is now satisfactorily established that the Ceylon race certainly extends throughout Travancore and Cochin, and I am inclined to attribute to it also birds from the Nilgiris, Wynaad and Bangalore.

The differences in the amount of black on the third and fourth outer tail feathers and in the size of bill usually attributed to this race do not appear to me to be constant, but the female is certainly darker both above and below than in the typical race: No. 1028 is so dark that had it not been satisfactorily sexed by dissection one would have hesitated to which sex to attribute it.

The juvenile ♂ No. 705 (in squamated plumage) is quite indistinguishable, however, from similar specimens from the Punjab and the Duars.

The post-juvenal moult in this species is complete. There is no prenuptial moult and the post-nuptial moult is complete. The moult appears to be remarkable at all ages for the sudden completeness with which the tail is shed, so that birds with a short stub tail are often seen in autumn. The post-nuptial moult in Travancore takes place about August.—H. W.]

The Magpie Robin is a fairly common species in Travancore and Cochin. It was met with by the Surveys more or less throughout the low country and also patchily and sparsely in the hills up to 3,500 ft. In the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, 74) through a slip it is stated that in Travancore

Ferguson regarded it as more particularly a bird of the *hills*. Actually Ferguson described it (*J.B.N.H.S.*, xv, 466) as '. . . essentially a bird of the *plains*'.

It inhabits secondary jungle and scrub country in the neighbourhood of cultivation and human habitations, being especially partial to the cashew and fruit gardens about homesteads along the backwaters.

Between 10 November and upto 8 December the males were observed as practically silent, the only notes then uttered being a prolonged and somewhat plaintive *swee-ee* and subdued harsh *chr-r*, *chr-r*, etc. The birds were also inordinately shy and kept mostly to undergrowth. On the latter date for the first time crude attempts at song were heard. From now on 'rudimentary' song or 'singing practice' was more and more commonly heard. By the middle of January individual males were singing full-throatedly from tree-tops both early morning and evening, but this had as yet not become general. The rapid growth and development of song thereafter, however, was marked, and by 15 February—about which date males were puffing and strutting about and chasing off rivals—it was heard on all sides.

In the Pālni Hills, Fairbank (*S.F.*, v, 406) found the Magpie Robin from the base up to 5,000 ft., but Terry (*S.F.*, x, 476) only saw it far down the slopes and did not think it ascended to any height.

It is common throughout Ceylon up to 5,500 ft.

Breeding: Ferguson (*J.B.N.H.S.*, xv, 466) says it breeds in February and March. The Surveys were unable to obtain any direct evidence on this point, but the behaviour of the cocks from about the middle of February onward certainly tends to confirm his statement. That it continues to breed longer is suggested by four of the specimens collected in July and August which were undergoing complete post-nuptial moult.

Kittacincla malabarica malabarica (Scopoli). The Shāma.

Specimen collected: 880 ♀ 18-11-33 Kūriārkūtti 1,600 ft.

Elsewhere not noted, but I have seen a specimen in the Trivandrum Museum labelled: ♀ 1-8-(70?) Kūttyāni.

Colours of bare parts: Iris brown; bill dark horny-brown; mouth pink; legs and feet pinkish flesh colour; claws dusky.

[Two specimens from Travancore (Biddulph) in the British Museum have no more precise data.

Measurements:

	Bill.	Wing.	Tail.
2 ♂♂	19.5-20	89-94	175-176 mm.
1 ♀	20	90.5	127.5 mm.

This female is of the richly coloured type which approaches the adult male in colouration as opposed to the much duller paler type in which the upper parts, chin and throat are dull ashy grey and the breast and abdomen fulvous rather than chestnut. I do not yet understand the plumages of this species and females are too rare in collections for me to decide whether these differences are due to age or individual variation or even possibly subspecific.—H. W.]

The specimen was one of a pair in dense bamboo and deciduous scrub jungle bordering a drag-path for logs. Several single examples were seen in this facies, once in a mixed bird association. They were silent and extremely shy.

Ferguson (*J.B.N.H.S.*, xv, 466) writes as follows: 'The Shāma is not common in Travancore; it frequents jungle and is decidedly shy. It does not ascend the hills.'

In the Pālni Hills, Fairbank (*S.F.*, v, 406) records hearing one singing at dusk in a thicket at the eastern base of the hills.

In Ceylon the Shāma is generally distributed upto about 3,500 ft.

Breeding: The ovary of the specimen was undeveloped. According to *Nidification* (ii, 106), Stewart found it breeding in Travancore during April.

Turdus simillimus mahrattensis Whistler. The Black-capped Blackbird.

Specimens collected: 89 ♂ 14-1-33 Marāiyūr 3,500 ft.; 104 ♂ 18-1-33 Mūnnār 5,000 ft.; 155 ♂ 25-1-33 Sānthanpāra 3,500 ft.; 271 ♀ 11-2-33

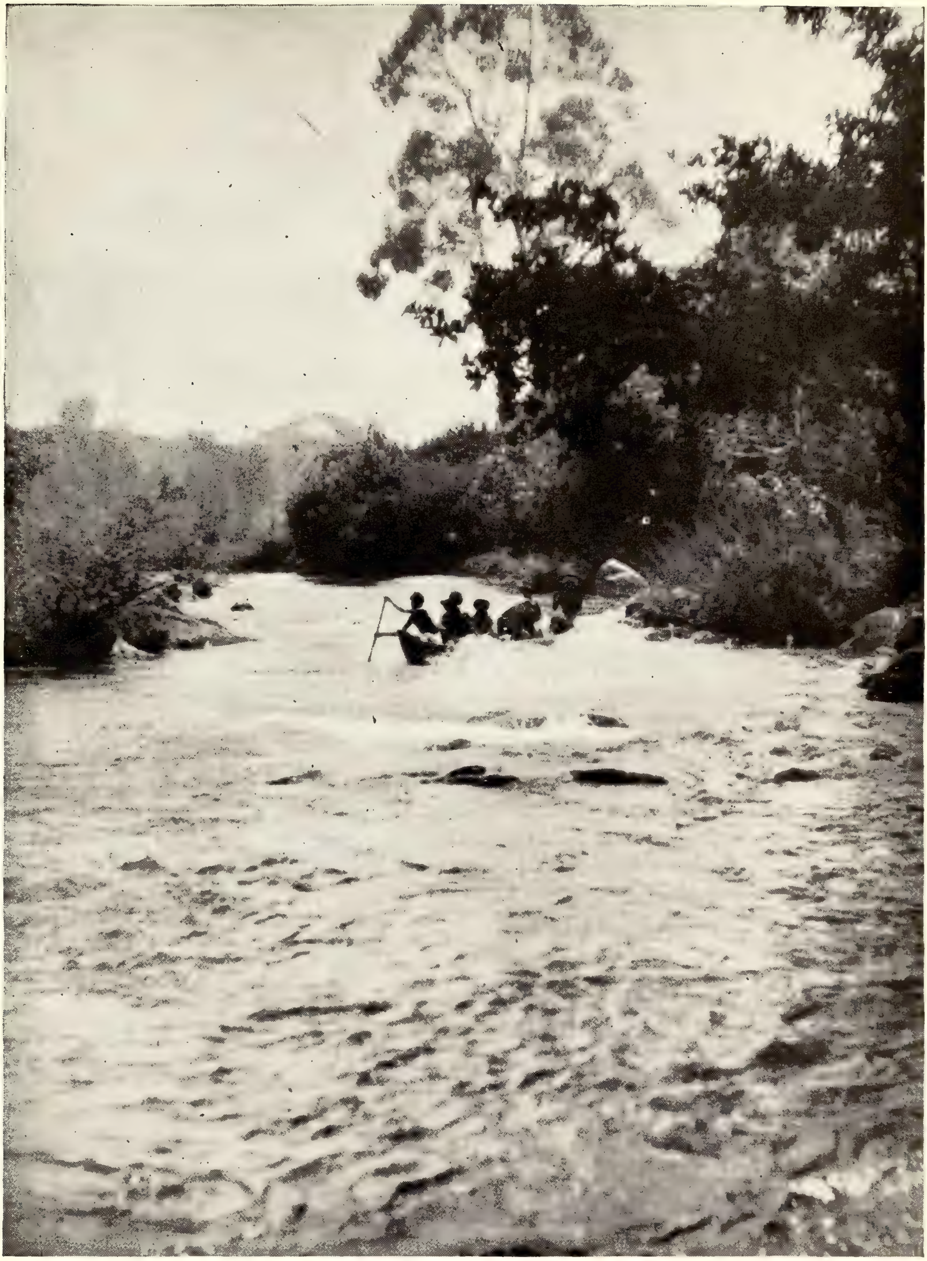

Photo by author.

Shooting the rapids—Periyār River below Thattākād. Ideal bird country on banks.

Thattākād 200 ft.; 319 ♀, 320 ♂ 21-2-33, 337 ♀ 23-2-33, 353 ♀ 24-2-33 Peermade 3,200 ft.; 883 ♂ 18-11-33 Kūriārkūtti 1,600 ft.; 969 ♀ 12-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Mūthūkūzhi (4,000 ft.—Ashāmbū Hills). This or *bourdilloni*?

Colours of bare parts: Iris hazel brown; eyelids orange; postorbital skin orange-brown, orange-yellow or rich orange corresponding with gape and bill; gape and bill horny-brown with orange patches at gape nostrils and sides, brownish-orange with dusky tips or bright orange with dusky tips; mouth orange-yellow; legs, feet and claws dusky orange-yellow.

[Additional specimen examined : ♂ 14-3-14 Cardamom Hills (Sparrow).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
5 ad. ♂♂	25-27	126.5-135	92-100	30-33-5 mm.
1 First winter ♂	—	121	89	— mm.
5 ♀♀	26.5-28	122-128.5	86.5-97.5	30-32.5 mm.

In the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, 75-6) I pointed out the difficulties in connection with these South Indian Blackbirds, and these difficulties chiefly pertain to the area of the Travancore-Cochin Surveys. Either the records are wrong or these Blackbirds cannot all be treated as races of one form. It may be as well first of all to summarise the records under the three of our areas to which they apply (I use here the name *nigripileus* as it occurs in the records.):—

Nelliampathy Hills.

(1) *nigripileus* very common. Generally terrestrial in habits and occurring in pairs, but I have seen large flocks in Lantana (Kinloch, *J.B.N.H.S.*, xxvii, 941).

(2) *bourdilloni*: common on the Lily Downs (4,700 ft.) and there replaces *nigripileus* the common bird of the plateau (Kinloch, *J.B.N.H.S.*, xxix, 565).

Palni Hills.

(1) *simillima*: (a) may be heard any evening in spring in the Kodaikanal and other groves above 4,000 ft. Two specimens (Fairbank, *S.F.*, v, 403).

(b) Very common everywhere in the sholas on the top. They commence breeding in the middle of March and were still breeding when I left in the middle of June (Terry, *S.F.*, x, 474).

(2) *nigripileus*: I found this bird at Pulungi, Pittur and Kukal. At the latter place it was quite common. I am sure it was breeding at the time I was there, May, but I was unable to find a nest (Terry, *loc. cit.*).

(3) *bourdilloni*: ♀ shot from 1 egg on 18 May. ♂ shot from c/2 eggs on 3 June. Details of nests (Terry, *loc. cit.* called *kinnisi*?).

Travancore.

(1) *bourdilloni*: Fairly common on High Range and above 3,500 ft. in the south (Ferguson, *J.B.N.H.S.*, xv, 466). Previously recorded by Bourdillon (*S.F.*, vii, 35) as *kinnisi*.

Mr. Stuart Baker in the new *Fauna* (ii, 125-129) and *Nidification* gives the breeding range of *simillimus* as the higher ranges of the Nilgiris, Brahmagiris and Palnis and of *bourdilloni* as the Palnis, Nelliampathies and Travancore, in both cases from 3,000 ft. upwards. This, if correct, would negative the idea that they are races of each other.

I think part of the difficulty may be removed by considering *nigripileus* (auct.) as a winter visitor. In the Eastern Ghats Report I pointed out that the above records were not substantiated by skins—and one has only to examine a large series of these Blackbirds to realise how variable they are and how difficult it is to be sure of the identifications—though I had found an undoubted male from the Cardamom Hills in Colonel Sparrow's collection, shot on 14 March 1914. The fine series collected by Mr. Sálim Ali now proves that this form does occur down to Travancore. Terry's May record is not incompatible with the bird being a winter migrant. *Tarsiger brunnea* which summers in the Himalayas, lingers down in the Nilgiris until May and it is an earlier breeder than *nigripileus* (auct.) which in Khandala breeds from July to September (*Nidification*, ii, 115). In the Nasik Ghats it certainly does not arrive until May (*J.B.N.H.S.*, iv, 239).

If *nigripileus* (auct.) can be proved to breed in our area, then it will be necessary to recognise two species *Merula simillimus* and *M. mahrattensis* of which latter *spencei* will be a race. The difference in wing formula would then be of importance as a means of separating the two species.

The remainder of the difficulty centres in the Palnis. I have only seen six skins from those hills, all in the British Museum. The two birds collected by Terry from his two nests and called *kinnisi* are in the British Museum. These are certainly *bourdilloni* as is a third bird collected by Terry on 1-6-83 with c/3 eggs which is in Dr. C. B. Ticehurst's collection. With it is another skin, unlabelled but evidently of the same batch. These two birds in Dr. Ticehurst's collection probably represent Terry's supposed *simillimus*. The other two specimens collected by Fairbank (Kodaikanal and Shemiganur) and now in the British Museum are not conclusive. They appear intermediate between *simillimus* and *bourdilloni* and suggest that the whole difficulty in the Palnis arises from its being an intermediate area. The final solution of the whole matter must be left to the field naturalist on the spot.—H. W.]

Since all the Blackbirds collected by the Surveys in Travancore and Cochin belong to this form, I assume that my field notes also relate to the same bird. It must be noted, however, that both Bourdillon and Ferguson met only the race *bourdilloni* in Travancore and that Kinloch also records the latter from the Nelliampathies, so that there is always a possibility of some confusion in my observations.

I found the Black-capped Blackbird common in the High Range and above 3,500 ft. in the south. I also met it at Thattākād (200 ft.) at the foot of the former, where however it was rare. It was most abundant at Peermade (3,200 ft.) and Pādagiri (3,000 ft.—Nelliampathies) while at Mūnnār (5,000 ft.) in the Kanan Dēvan Hills it was also common. It kept to evergreen sholas principally about their periphery and was frequently to be seen feeding on the edge of paths and forest traces early in the mornings and at dusk singly, or in pairs or small parties.

Its food consisted to a very large extent of the berries of *Maesa perottetiana* DC., *Trema orientalis* Blume and *Lantana camara* while the birds also invariably resorted to feed on the nectar of the blossoms of *Erythrina lithosperma* shade trees in tea and coffee plantations wherever suitably situated.

Between November and February the Blackbird was silent except for a subdued but sharp high-pitched *kree-ee* uttered from time to time, varied occasionally by a throaty, quick-repeated *chuck-chuck-chuck*. Their silence at this season probably made them appear less common in many localities than they actually were.

On 1 February I have the first record of one trying to sing. It was a half-hearted effort of short duration and punctuated every now and again with the throaty *chucks*. By the last date of which I have a record (25 April—Mūthūkūzhi 4,000 ft.; Ashāmbū Hills), males were in full song about that elevation.

Breeding: It is doubtful if the Black-capped Blackbird breeds in Travancore or Cochin. The gonads of the specimens furnished no indication in this regard. It was noted, however, that the February specimens had either completed moult into fresh nuptial plumage or were in varying stages of doing so.

Turdus simillimus bourdilloni (Seebohm). Bourdillon's Blackbird.

Not met with by the Surveys, but Ferguson records it as common in the High Range and above 3,500 ft. in the southern Travancore hills.

Mr. Whistler has examined tht following specimens: *Brit. Museum*: ♂ 4-97, ♂ 4-98 Chimunji (Ferguson); ♂ 29-3-77 Mynall (Bourdillon); [♂] albinistic no date, High Range 7,000 ft.; ♂ 5-91 High Range (Turner); ♂ 2-1-94 'Glenbritten'; ♂ 27-12-93 Chimunji; ♂ 17-4-80 Colathoorpolay, Patnas (F. Bourdillon); ♀ 97, ♀ 4-97 High Range (Ingleby); ♀ 5-91 High Range (Turner); [♀] 29-12-93, [♀] 4-98 Chimunji (Ferguson); ♀ 28-7-72 Pannuyar (?); ♂ 3-6-83 Kodaikanal (Terry); ♀ 18-5-83, juv. 17-5-83 Kukal, Pālni Hills (Terry). *Trivandrum Museum*: ♂ 18-1-01 Moonar, ♂ 5-3-03 Chimanji; ♀ 3-97 High Range (Ingleby); o? 22-1-01 Devicolum.

He measures Travancore specimens only, as follows:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	26-27	122.5-123.5	97-100.5	31.5-34 mm.
3 ♀♀	26-28	119.5-122	93.5-97.5	31-32.5 mm.

Breeding: Bourdillon and Ferguson (*J.B.N.H.S.*, xv, 466) took a nest at Chimunji in April (1903). *Nidification* (ii, 113) records another nest containing c/2 fresh eggs by the former on 14 May in dense evergreen forest at 3,500 ft. Mr. Stuart Baker (*loc. cit.*) also mentions that Kinloch took several nests in April in the Nelliampathy Hills 'undoubtedly' of this race and the 'builders are now in the Bombay Museum'. Inquiries at the Bombay Natural History Society reveal that there are now no skins collected by Kinloch in the Nelliampathies in their collection, and it is evident that the record requires fresh substantiation.

In the Pālni Hills, Terry took a nest with 1 egg on 18 May (1883) and another with c/3 on 3 June. He shot the owners which are now in the British Museum. A third bird shot by him from a nest with 3 eggs is in Dr. C. B. Ticehurst's collection.

Turdus simillimus simillimus (Jerdon). The Nilgiri Blackbird.

Not met with by the Surveys neither recorded by Ferguson or Bourdillon in Travancore nor by Kinloch in the Nelliampathies. In the Pālni Hills, however, both Fairbank and Terry record it as common at Kodaikanal and everywhere in the sholas above 4,000 ft. According to Terry (*S.F.*, x, 474) they breed there from the middle of March to the middle of June at least. Fairbank obtained two specimens (*S.F.*, v, 403) which are now in the British Museum. As noted above these two specimens are somewhat intermediate in character.

Geokichla wardii (Blyth). The Pied Ground Thrush.

Not met with by the Surveys.

The Pied Ground Thrush occurs in the Travancore-Cochin area apparently only as a rare passage migrant between its breeding haunts (viz. moderate elevations in the Himalayas from Kulu to Simla eastwards and in North Assam) and its winter quarters in Ceylon. The meagre records from the intervening peninsular area suggest that the bird travels by the Eastern Ghats route and does not linger much on the way.

Kinloch (*J.B.N.H.S.*, xxvii, 944) observed a single male in the Nelliampathy Hills in March which he considered to be on passage.

In Travancore, Ferguson (*J.B.N.H.S.*, xv, 466) obtained one in February on the High Range.

In the Palni Hills, Terry (*S.F.*, x, 474) procured a female on 1 March and a male on 3 March in thick sholas about a mile apart at Pulungi.

Its numbers in Ceylon are said to vary considerably in different years.

Geokichla citrina cyanotus (Jardine & Selby). The White-throated Ground-Thrush.

Specimens collected: 161 ♀ imm. 26-1-33 Sānthanpāra 3,500 ft.; 251 ♀ 9-2-33 Thattākād 200 ft.; 344 ♂ 23-2-33 Peermade 3,200 ft.; 496 ♂ 26-3-33 Tenmalāi 500 ft.; 905 ♀ 26-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Rājampāra (1,350 ft.—Panthalam Hills).

Colours of bare parts: Iris brown; bill blackish-brown, paler at chin; mouth yellowish-pink, pale pink, or greyish-pink with brown blotches on palate; legs and feet brownish flesh colour; claws duskier.

[Other material examined:

Brit. Mus. Coll.: ♂ 6-9-78, ♀ 30-11-84 Mynall (Bourdillon).
Sparrow Coll.: ♀ 28-3-14 Cardamom Hills.

Measurements:

	Bill.	Wing.	Tail.
3 ♂♂	23.5-24	111.5-113.5	73.5-80 mm.
5 ♀♀	22.5-24.5	105-110.5	73-75 mm.—H. W.]

The White-throated Ground Thrush was met with at elevations up to 3,500 ft. in Travancore and Cochin, being fairly common in shady cardamom sholas and well-wooded country, both deciduous and evergreen. It is usually met singly or in pairs and is particularily fond of overgrown ravines and nullahs. It feeds on the ground among the mulch and brushwood, but promptly flies up into the overhanging branches of trees on taking alarm. The only note heard between 24 November and 26 March (being dates on which it was first and last seen) was a subdued but high-pitched *kree-ee*.

I cannot throw any light on its status in this area. Both Bourdillon (*S.F.*, iv, 398) and Ferguson (*J.B.N.H.S.*, xv, 467) considered it a winter visitor, but *Nidification* (ii, 132) records the former taking nests in Travancore with eggs or young in May and June! Kinloch lists it as 'very common' in the Nelliampathies, but is silent as regards its status. Pillai evidently failed to meet it at Kūttyāni and other wooded groves in the environs of Trivandrum town between 15 July and 15 August.

The gonads of all the Survey specimens were in a quiescent state. No. 161 (26 January) was not fully adult as evidenced by the imperfect ossification of its skull.

This race has not been recorded from Ceylon though the northern (typical) race has occurred there 2 or 3 times.

Oreocincla dauma neilgherriensis Blyth. The Nilgiri Thrush.

Not met with by the Surveys. I have seen a specimen in the Trivandrum Museum said to come from Travancore, but lacking precise data.

According to Ferguson (*J.B.N.H.S.*, xv, 467) the Nilgiri Thrush is rare in Travancore, being found in the High Range above 4,000 ft. and also sparingly in the south. W. F. Bourdillon found it sparingly in thick jungle from the summit of the hills (in Central Travancore) down to about 2,000 ft. elevation.

Kinloch (*J.B.N.H.S.*, xxix, 564-5) records it as numerous on the Lily Downs (4,700 ft.) in the Cochin Nelliāmpathies.

In the Pālni Hills, according to Terry (*S.F.*, x, 474) it breeds, but apparently there are no records of its doing so in Travancore or Cochin.

Monticola cinclorhyncha (Vigors). The Blue-headed Rock-Thrush.

Specimens collected: 45 ♀ 9-1-33, 55 ♂ 10-1-33 Marāiyūr 3,500 ft.; 366 ♂ 27-2-33 Kūmili 3,000 ft.; 454 ♂, 455 ♀ 17-3-33, 481 ♂, 482 ♀ 21-3-33 Rājampāra 1,350 ft.; 881 ♂ 18-11-33 Kūriārkūtti 1,600 ft.; 998 ♀ 20-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Nemmāra (300 ft.).

Colours of bare parts: Iris dark brown; bill dark horny-brown, yellow at gape and on commissure and chin; gape and mouth yellow; legs, feet and claws greyish- or horny-brown; soles pale yellow.

[The Survey specimens measure:

	Bill.	Wing.	Tail.
4 ♂♂	23.5-24	101.5-105	69.5-71.5 mm.
3 ♀♀	23.5	98.5-101	66-67.5 mm.

There are 8 specimens in the British Museum from Mynall (Bourdillon) dated November (earliest date 13th), December, January and 9 March.

Nos. 45 and 55 are first winter birds. I do not understand the statement in the *Fauna* (ii, 182) that the young male is like the female. In neither juvenile plumage nor in first winter plumage does it resemble the adult female. In the juvenile male the upper plumage, including the lesser and median wing-coverts, is fulvous-yellow, each feather edged with brownish-black, giving a squamated appearance. The lower rump and upper tail coverts are pale chestnut, the feathers of the former lightly fringed with black. Lower parts similar to upper parts but paler, the squamation less marked on the throat, vent and undertail coverts. The wings and tail resemble those of the adult male but the primary and greater coverts have fulvous edges, the fulvous edges to the tertiaries are wider than in the adult, and the blue of the wing generally is much duller. The tail is lightly tipped with bright fulvous. The juvenile female has the same squamated plumage but lacks the chestnut rump-patch and the wings and tail are similar to those of the adult female, the greater coverts and tertiaries being edged with pale fulvous.

This plumage is changed at the post-juvenal moult which takes place between July and September. The primaries and primary coverts, the secondaries and greater coverts, the tertiaries and tail are not then moulted and the first winter and first summer plumage differs only from the respective adult plumage in both sexes by the retention of those feathers until the second autumn moult which is complete. Adults have a complete moult about August and September. There is no spring moult, but the wearing off of the fringes to the feathers makes the summer plumage a little darker.—H. W.]

This Thrush is also a fairly common winter visitor in the Travancore-Cochin area, from the level of the low country to at least 3,500 ft., and doubtless higher. I do not seem to have come across it at Mūnnār or elsewhere about that elevation, but Ferguson found it at 5,000 ft. in the High Range. It is partial to broken country or stony hillsides covered with light deciduous and bamboo jungle, rather than to the more heavily wooded parts beloved of the White-throated Ground-Thrush. Its favourite facies may in fact be described in general terms as intermediate between the heavily wooded patches frequented by *Geokichla citrina* and the open sparsely covered rocky hillsides etc. preferred by *Monticola solitaria.*

Cardamom sholas and coffee plantations also provide admirable hunting grounds for this species. It was frequently met with singly in thin jungle about villages and cultivation, and it has the same habit of flying silently up into the overhanging branches of trees when disturbed. Sometimes the bird will descend to the ground to pick up an insect and fly up with it to its perch, very much in the manner of a Bush-chat.

Kinloch describes it as common in the Nelliampathy Hills, presumably in winter.

It has not been recorded from Ceylon.

The gonads of the specimens were in an undeveloped condition. Specimens Nos. 454, 455 (17 March) and 481 (21 March) were extremely fat and were obviously ready to emigrate. The fat scraped off the last named weighed 86 grains! No. 482 (21 March) was an immature bird with skull as yet imperfectly ossified. It was noted that about this time there was an overwhelming preponderance of males (as judged from plumage), a fact suggesting that the females had preceded the males on the outward migration.

A remarkable instance of a female (dissection and sexing confirmed!) assuming adult male plumage was noted in the case of specimen No. 455. The bird appeared in perfectly healthy condition and, as mentioned, was very fat.

Monticola solitaria pandoo (Sykes). The Indian Blue Rock-Thrush.

Specimens collected: 93 ♀ 14-1-33 Marāiyūr 3,500 ft.; 118 ♂ 20-1-33 Mūnnār 5,000 ft.; 346 ♂ 24-2-33 Peermade 3,500 ft.; 949 ♂ 6-12-33 Nemmāra 300 ft.

Elsewhere noted at: Sānthanpāra (3,500 ft.), Arāmboli (250 ft.).

Colours of bare parts: Iris brown; bill, legs, feet and claws blackish-brown; mouth lemon yellow or yellowish-pink.

[Measurements:

	Bill.	Wing.	Tail.
3 ♂♂	24.5-27	118-125	77.5-83 mm.
1 ♀	28.5	113.5	78.5 mm.

No. 93 is a first winter bird. This species has the same plumage sequence as in *Monticola cinclorhyncha.* The juvenile male is sooty-brown washed with bluish-grey, the feathers of the crown, sides of the face, chin, throat and upper breast with subterminal pale fulvous spots, the rest of the feathers faintly fringed with fulvous; wings and tail as in the adult male, but greater coverts and tail with broader pale edges. The juvenile female is similar but paler and browner, the wings and tail as in the adult female. The post-juvenal moult takes place about August-September and does not include the primaries and primary coverts, the secondaries and all but the inner greater coverts or the tail. These are not moulted till the second autumn. The adults undergo a complete moult about August to October. There is no spring moult.

Both male and female show a certain amount of variation in the amount of spotting and barring of the body plumage.—H. W.]

The Blue Rock-Thrush is also a fairly common winter visitor to Travancore-Cochin. First seen 6 December; last 21 April. It is almost invariably seen as a solitary bird frequenting both low hummocky country and up to at least 5,000 ft. in the hills. It is essential, however, that the locality be open with plenty of sheet rock or scarps amidst sparse scrub with scraggy tufts of grass growing out of the crevices, such as is typical of the drier hillsides in this area. Stone quarries never fail to attract it. Kinloch also found it common in such facies in the Nelliampathy Hills. The only record of its occurrence in the Pālnis is apparently that of Capt. Bates from Kodaikanal on 6 April (1929, *J.B.N.H.S.*, xxxvi, 80).

It is a straggler to Ceylon (November-March).

Its food consists principally of insects, but I have frequently observed it feeding largely on the berries of *Lantana camara*.

The organs of the specimens showed no departure from the normal non-breeding condition.

Myophonus horsfieldii Vigors. The Malabar Whistling Thrush.

Specimens collected: 35 ♂ 7-1-33 Marāiyūr 3,500 ft.; 654 ♀ 24-4-33 Balamore Estate 2,000 ft.; 924 ♂ 30-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Mūnnār (5,000 ft.), Sānthanpāra (3,500 ft.), Thattākād (200 ft.), Mūndakāyam (ca. 1,000 ft.), Peermade (3,200 ft.), Kūmili (3,000 ft.), Rājampāra (1,350 ft.), Tenmalāi (500 ft.), Kūvallē (along Cochin Forest Tramway), Kūriārkūtti (1,600 ft.), Pādagiri (3,000 ft.).

Colours of bare parts: Iris hazel brown; bill, legs, feet and claws black; mouth pale yellow or creamy pink.

[Further specimens examined: *Brit. Mus. Coll.*: ♂ 3-7-78, ♀ 2-12-74 Mynall (Bourdillon).

Travancore-Cochin specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
3 ♂♂	32.5-34.5	155.5-158.5	112-113.5	44-49 mm.
2 ♀♀	29.5	143.5-148	103-108	42-45 mm.

It is difficult to settle whether to consider this bird as a race of *M. cœruleus* or as a separate species. It is evidently from the same stock and reflects many features of the parent form. At the same time it has evidently been isolated for so long a period and has advanced so far on different lines that it has now really attained the rank of a separate species.—H. W.]

The Whistling Thrush is a common and familiar species throughout the forested portions of the Travancore-Cochin area in the foothills as well as higher up to at least 5,000 ft. elevation. It frequents the vicinity of streams and torrents, often about villages and human habitations. Its call is one of the earliest bird voices to be heard in the morning, being followed soon after by the Pitta. In December and January the rich rambling whistling song was seldom heard, but by the end of March and in April it had increased in frequency.

The bird moves about on the ground and on rocks in or by the streams in short hops, constantly jerking its tail and spreading it fanwise.

In the Pālni Hills, Fairbank and Terry both found it in sholas and wherever there was running water, from the base up to 5,000 ft.

It does not occur in Ceylon where it is apparently represented by the endemic *Arrenga blighi.*

Breeding: The gonads of the specimens were in an undeveloped condition. According to T. F. Bourdillon, the season in Travancore is April and May, the normal clutch comprising of 3 eggs. *Nidification* (ii, 154-5) gives June to August as the usual breeding season in Travancore, but mentions Stewart taking a nest as early as 13 February. It suggests that probably the birds breed twice.

At Panchgani (4,400 ft.—Western Ghats) I found breeding to be in full swing in July and August (1931). Two successive broods were common and the period of incubation was determined to be 16-17 days.

FAMILY: MUSCICAPIDAE.

Siphia parva albicilla (Pallas). The Eastern Red-breasted Flycatcher.

Specimen collected: 388 [♂] 1-3-33 Kūmili 3,000 ft.

Elsewhere not noted.

Colours of bare parts: Iris dark brown; bill blackish-brown except chin and gape which whitish; mouth yellow; legs, feet and claws blackish-brown.

[The specimen is an adult male in full red-breasted plumage. This is a considerable extension of range for this species. The typical race has not been recorded below S. Mysore at the foot of the Nilgiris on the Bangalore road (Hume, *S.F.*, x, 372) and *S. p. albicilla* has not been recorded south of Belgaum (♀ 22-10-1879 Butler) and the Nallamalais (♂ imm. 7-11-29 Eastern Ghats Survey, *J.B.N.H.S.*, xxxvi, 81).

This specimen is undergoing the spring moult which appears to be chiefly confined to the red patch and its grey edging. First year males and females are alike and can only be distinguished from the adult female by the fact that the post-juvenal moult does not include the tertiaries, greater and primary coverts and wing quills which remain from the juvenile dress. The first year male evidently attains the red throat and grey edging in the first spring moult. —H. W.]

The specimen—the only one of the species met with in Travancore or Cochin —was shot off a large mango tree adjacent to the camp shed. Here it was fitting about in pretty twisting sallies after insects in among the branches or thence on to fence-posts or the ground to pick up an insect and back again uttering its characteristic *click, click* from time to time as it jerked its cocked-up tail.

The gonads were not distinct enough for the specimen to be sexed with certainty.

The Survey was unable to confirm the statement in the *Fauna* (ii, 211) that the typical race of this Flycatcher occurs in winter as far south as Travancore. Ferguson's list does not record it thence while neither Fairbank nor Terry appear to have met it in the Pālni Hills.

Muscicapula pallipes pallipes Jerdon. The White-bellied Blue Flycatcher.

Specimens collected: 129 ♂ 23-1-33 Sānthanpāra 3,500 ft.; 350 [♂] 24-2-33 Peermade 3,200 ft.; 373 ♀ 28-2-33, 393 ♀ 3-3-33, 404 ♀, 405 ♂ 5-3-33 Kūmili 3,000 ft.; 493 ♂ 26-3-33 Tenmalāi 500 ft.; 867 ♂ 15-11-33, 870 ♀ 16-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Mūndakāyam (ca. 1,000 ft.), Pādagiri (3,000 ft.— Nelliāmpathy Hills.)

Colours of bare parts: Iris brown; bill brownish-black; mouth slaty-pink or greyish-pink; legs and feet horny-brown.

[The Survey specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
5 ♂♂	17.5	73-79	57.5-63	18.5-19 mm.
4 ♀♀	15.5-17	72.5-75.5	55-61.5	18.5 mm.

Other specimens examined:

Brit. Mus. Coll.: ♂ 24-2-78 Travancore; o? n.d. Mynall (Bourdillon); o? juv. 9-90 Chimunji (Ferguson)—labelled *muttui*.—H. W.]

The White-bellied Blue Flycatcher though not numerically abundant, is common as a species in evergreen forest tracts throughout the two States. The lowest elevation at which I came across it was about 500 ft., the highest 3,500 ft., but as in the Nilgiris, it is probably also found higher up in the hills. It is a quiet unobtrusive little bird, keeping mostly to the dense undergrowth of tall lanky seedlings or *Strobilanthes*, and is frequently a member of the localised bird associations common to this facies. It is also partial to cardamom sholas where it frequents the vicinity of the overgrown nullahs or ravines that run through them. Usually seen singly, most birds appeared to have paired off from about the beginning of March. It has a habit of screwing its tail from side to side like the Thick-billed Flowerpecker.

The species does not seem to have been recorded from the Pālnis.

It does not occur in Ceylon.

Breeding: In No. 373 (28 February) the ovary was distinctly granular and the follicles were further enlarged in 393 (3 March) and in 404 (5 March). The testes of 405 (pair to the last, and same date) measured 5×3 mm., those of 493 (26 March) 7×5 mm. All the birds were in immaculate plumage and appeared to be breeding or about to. The rest of the specimens showed no genital development.

Stuart Baker records (*Nidification*, ii, 195) that J. Stewart took nests in Travancore between 1 and 2,000 ft. elevation chiefly during the rains, but that he also found some as early as February and others as late as September. The normal clutch is said to be almost invariably of 4 eggs.

The evidence obtained by the Surveys tends to confirm the usual breeding season given in the *Fauna* (ii, 228) as March and April.

Muscicapula rubeculoides rubeculoides (Vigors). The Blue-throated Flycatcher.

Specimens collected: 238 [♀] 7-2-33 Thattākād 200 ft.; 463 ♂ 18-3-33 Rājampāra 1,350 ft.

Elsewhere not noted.

Colours of bare parts: Iris brown; bill brownish-black; mouth greyish-pink or slaty-pink; legs, feet and claws greyish-brown (with a pinkish tinge in No. 238).

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
♂	broken	75	56.5	— mm.
♀	16	72.5	missing	15.5 mm.

This is a new record for Travancore, though the bird has several times been recorded from the Madras Presidency.—H. W.].

This Flycatcher—apparently a winter visitor only—was usually seen singly in scrub and secondary jungle with tangles of creepers, on the fringe of evergreen forest.

No. 463 (18 March) was excessively fat and evidently preparing to emigrate. A very marked preponderance of males over females was noted at Rājampāra about the time the specimen was secured. The trill of the male which was being frequently uttered, is similar to yet clearly distinguishable from that of Tickell's Blue Flycatcher also present in the same locality, and in common with the latter it has the characteristic flycatcher habit of flicking its cocked-up tail and uttering *chr-r*, *chr-r* or *click, click*.

In Ceylon it is apparently not an uncommon winter visitor from October to April.

Muscicapula tickelliae tickelliae (Blyth). Tickell's Blue Flycatcher.

Specimens collected: 44 ♂ 9-1-33 Marāiyūr 3,500 ft.; 452 ♂ 17-3-33, 470 ♂ 19-3-33, 484 ♀ 21-3-33 Rājampāra 1,350 ft.; 884 ♂ 18-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Mūnnār (5,000 ft.), Thattākād (200 ft.), Wadakkāncheri (400 ft.).

Colours of bare parts: Iris dark brown; bill brownish-black; mouth slaty-pink; legs and feet greyish-brown; claws brown.

[Other specimens examined:

B. M. Coll.: o? 28-5-77 Pālni Hills (Fairbank).
Sparrow Coll.: ♂ 1-4-14 Kūmili, Travancore.

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
5 ♂♂	14.5-16	70-76.5	55-68	16.5-17 mm.
1 ♀	15	69	55	16 mm.—H. W.]

Tickell's Blue Flycatcher, though curiously enough not appearing in Ferguson's Travancore list, is a fairly common species in our area. It avoids evergreen forest and prefers opener scrub and secondary jungle of more or less deciduous aspect, especially where intermixed with bamboo or Eeta (*Ochlandra*). I came across it between 200 and 5,000 ft. elevation. Its freely repeated musical little trill invariably gave away its presence long before the bird was seen. This song is apparently uttered all the year round, though more frequently during the breeding season.

Fairbank (*S.F.*, v, 402) obtained a specimen in the Pālni Hills (evidently the one now in the British Museum) and observed it 'unfrequently from top to bottom', while Terry (*S.F.*, x, 473) found it breeding in the Pittur Valley. Kinloch also obtained nests in the Pālnis (*Nidification*, ii, 202).

In Ceylon it is represented by the race *mesœa* which is endemic to the island.

Breeding: The November and January specimens showed no genital development. Nos. 452 (17 March) and 470 (19 March) on the other hand both had testes enlarged to 6×4 and 5×4 mm. respectively, while the female (No. 484—21 March) had a distinctly granular ovary and a prominent incubation patch. All the 3 latter were in freshly moulted plumage.

On 21 March also, a male was observed conveying building material—a bunch of fibres—in its bill, and nesting was obviously in progress.

Eumiyas thalassina thalassina (Swainson). The Verditer Flycatcher.

Specimen collected: 191 ♂ 30-1-33 Sānthanpāra 3,500 ft.

Elsewhere noted at: Thattākād (200 ft.), Peermade (3,200 ft.).

Colours of bare parts: Iris brown; bill horny-black; mouth pale yellowish-flesh colour; legs, feet and claws blackish-brown.

[The Survey male measures:

Bill.	Wing.	Tail.	Tarsus.
14	86	70	17 mm.

Other specimens examined:

B. M. Coll.: ♀ 20-11-74, ♂ 2-12-78, ♂ 27-11-74 Mynall (Bourdillon).—H. W.]

This Flycatcher (a winter visitor) is certainly much less common than the following species which it closely resembles in habits. Ferguson did not come across it in Travancore, but Bourdillon who procured the above specimens notes it as a common though not abundant winter visitor 'up to 2,000 ft.' from December to March. I did not meet with it in Cochin although Kinloch (*J.B.N.H.S.*, xxvii, 939-44) describes it as 'very common' in the Nelliampathies in the cold weather till the end of March at comparatively low elevations. He obtained a specimen at 3,300 ft.

Neither Fairbank nor Terry have recorded it from the Pālni Hills though it must doubtless occur there in the cold weather.

It is not recorded from Ceylon.

The distribution of this Flycatcher in *Nidification* (ii, 206) is rather misleadingly worded. So far we have no evidence that the bird breeds anywhere in India proper south of the Himalayas.

Eumiyas albicaudata (Jerdon). The Nilgiri Verditer Flycatcher.

Specimens collected: 2 ♀ 4-1-33, 20 ♂ 6-1-33, 49 ♀ imm. 9-1-33 Marāiyūr 3,500-4,500 ft.; 102 ♂ 17-1-33 Mūnnār 5,000 ft.; 153 ♂ 25-1-33 Sānthanpāra 3,500 ft.; 428 ♂ 9-3-33 Camp Derāmalāi 3,000 ft.; 995 ♂ 19-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Mūthūkūzhi (4,000 ft.—Ashāmbū Hills).

Colours of bare parts: Iris dark brown; bill horny-black (somewhat browner in imm. No. 49); mouth geyish-pink or brownish-pink; legs, feet and claws blackish-brown.

[There is a series from the Pālnis and a ♂ February 1892 Devikulam (O. W. Turner) in the British Museum.

Travancore and Pālni specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
7 ♂♂	14-15.5	75.5-81	59-66	18.5-19.5 mm.
2 ♀♀	13-15	76-77	56.5-60.5	18.5 mm.—H. W.]

The Nilgiri Verditer Flycatcher is a common and abundant species throughout the forested hills of Travancore and Cochin. I came across it between 3,000 and 5,000 ft. and this is clearly the range of elevation it favours most. It is usually met singly frequenting overgrown hill streams and nullahs, undergrowth flanking paths and traces through sholas, cardamom plantations and the edge of forest clearings, often in association with *Culicicapa*, *Alseonax muttui*, and other flycatchers.

The males have a pleasant trilly song somewhat feebler than but similar in quality to that of *Saxicola caprata*. It lasts from 5 to 10 seconds and is constantly uttered from some exposed twig on the top of a tree. I have notes of birds singing in every month while the Surveys were in the field, from December to April. Ordinarily it perches somewhat upright on a twig and utters the typical flycatcher *click, click* as it twitches its tail up and down.

In the Pālni Hills, Fairbank (*S.F.*, v, 402) found this Flycatcher an abundant inhabitant of Kodaikanal and other groves from 5,500 ft. to the summit of the hills.

In Ceylon it is represented by an allied species *E. ceylonensis* (=*sordida*).

Breeding: The specimens furnished no evidence of breeding and apparently there are no actual records of nests and eggs taken in Travancore or Cochin. It is a permanent resident, however, and known to breed in the adjacent portions of its range between March and May, occasional nests being found in February or June. Mr. Stuart Baker has records of its occurrence and breeding in the Pālni Hills, the Wynaad, Palghat and Southern Malabar (*Nidification*, ii, 210).

Alseonax latirostris (Raffles). The Brown Flycatcher.

Specimens collected: 51 ♂ 10-1-33 Marāiyūr 3,500 ft.; 204 ♀ 3-2-33, 262 ♀ 10-2-33 Thattākād 200 ft.; 362 ♂ 27-2-33, 386 ♂ 1-3-33, 397 ♂ 3-3-33, 402 o? 5-3-33 Kūmili 3,000 ft.; 433 o? 10-3-33 Camp Derāmalāi 3,000 ft.; 444 ♂ 16-3-33, 478 ♀ 21-3-33 Rājampāra 1,350 ft.; 990 ♀ 18-12-33 Pādagiri 3,000 ft.; 1020 ♀ Karūpadanna ca. S.L.

Elsewhere noted at: Wūndamet (ca. 3,500 ft.), Trivandrum (ca. S.L.), Kūvallē (ca. 1,000 ft.) along Cochin Forest Tramway, Nemmāra (300 ft.), Wadakkāncheri (300 ft.).

Colours of bare parts: Iris dark brown; upper mandible and tip of lower mandible horny-brown; rest of lower mandible cream colour (in No. 402 lower mandible—except tip—chrome yellow!); mouth pale yellow or pale yellowish-pink; legs, feet and claws horny-brown.

[Other specimens examined:

B. M. Coll.: ♂ 30-12-80 Kallaur road 1,000 ft. (Bourdillon); ooo no dates Mynall; ♀ 7-3-77, ♂ 18-10-78 Mynall; o? -3-75 Eridge.

Travancore specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
7 ♂♂	12.5-15	69.5-76	48-54	12.5-14.5 mm.
6 ♀♀	12.5-15.5	69-73	46-51.5	—

This bird is now on the British list and therefore finds inclusion in Witherby's *Practical Handbook of British Birds,* vol. i, p. 287. The juvenile is there described from specimens of which the correct identification appears uncertain, and as the description does not agree with a specimen collected by me personally from a family party of which the adult male was also collected (23 June 1921 near Larji 3,000 ft., Valley of the Beas, Kulu) a full description may be given: Crown, nape, hindneck, mantle, scapulars, lesser wing-coverts, back and rump pale fulvous buff, each feather with a dark brown fringe and a grey base, the general appearance being squamated; median wing-coverts dark brown, with a large triangular buff spot at tip of each feather; greater wing-coverts dark brown, edged exteriorly and broadly tipped with warm fulvous; primary coverts dark brown, the tips lightly edged with buff; primaries, secondaries and tertiaries as in the adult, except that the tertiaries have the pale buff border rather broader at the tips; upper tail coverts dark brown broadly tipped with fulvous; tail as in the adult, the feathers with a small buff spot at their tips; sides of the head and neck mottled brown and buff; lower plumage white, faintly washed with buff on the chin, throat and breast, all feathers except on centre of abdomen lightly fringed or tipped with dark brown, giving a faintly squamated appearance.

This plumage is moulted at the post-juvenal moult with the exception of the greater and primary coverts, primaries, secondaries and tertiaries and probably tail, but wear and fading soon render it impossible to separate first winter birds and adults with certainty. The post-nuptial moult is complete and takes place about August to October. There is, I think, no spring moult in the adult. It will be noted that my view of the moults of this species differs considerably from that given in the *Practical Handbook*.—H. W.]

The Brown Flycatcher was met by the Surveys between 11 November and 30 March, after which date it was not seen at all. The fact that specimens collected on 10 and 16 March were excessively fat, suggests that at about this time most birds were preparing to emigrate although the last specimen, obtained on 21 March, was in normal condition. There is great uncertainty as regards the status of this Flycatcher in the Travancore-Cochin area as indeed there is in the other parts of its Indian and south-eastern range. Ferguson considered it a common winter visitor to Travancore but thought that some individuals breed there as he had specimens collected in June and August (*J.B.N.H.S.*, xv, 464). Personally I am not in a position to say anything definite on the subject as I was not in the area during May and June which is said (*Fauna*, ii, 250) to be the breeding season everywhere. Pillai who collected during July and August in the environs of Trivandrum—whence I have sight records for March—does not appear to have come across the species then. It is possible that odd pairs occasionally remain to breed as in North Kanara which is the nearest *known* breeding place (Davidson, *J.B.N.H.S.*, xi, 668). Indeed that they may well do so is more than suggested by the testes of No. 362 (27 February) which had enlarged to 6×3 mm.

The Surveys found the Brown Flycatcher fairly common in Travancore-Cochin from about sea-level up to at least 3,500 ft. in the hills. It affects sparse deciduous jungle (commonest at Kūmili!) and avoids evergreen forest, though it may frequently be seen on the verge of this where it opens out into grassland. The bird is partial to the neighbourhood of rocky hillstreams and was also commonly met with in and about rubber plantations, among the shade trees of comparatively open cardamom sholas and in the mango, jack and cashew gardens by homesteads along the backwaters. It is usually seen singly, sometimes in pairs.

The only notes I heard it utter were a feeble *chi-chir-ri-ri-ri* something like *Dumetia*, but feebler.

This Flycatcher is apparently rare in the Pālni Hills as both Fairbanks and Terry met it only once. No dates are given and no comment on its status is made.

It is a winter visitor to Ceylon from October to April (Legge), but according to Wait it has also been obtained in the Island in June.

The gonads of the specimens were in a quiescent state except in the case of the ♂ mentioned.

Messrs. Whistler and Kinnear (*J.B.N.H.S.*, xxxvi, 86) after examining a considerable number of specimens of this species from the different parts of its wide range are not satisfied that it has any races. In a recent work on the birds of North-Eastern Asia,[1] Sten Bergman gives the wing measurements of 3 ♂♂ obtained in the Kuril Islands listed by him under the typical race. The figures—70-72 mm.—correspond closely enough with those given by Whistler and Kinnear for 4 ♂♂ from Amur Bay, Eastern Siberia (68.5-71 mm.) to support their contention of the non-existence of races.

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[1] Zur Kenntnis nordöstasiatischer Vögel, Sten Bergman, Stockholm (1935).

Alseonax ruficauda (Swainson). The Rufous-tailed Flycatcher.

Specimen collected: 377 ♀ 28-2-33 Kūmili 3,000 ft.

Elsewhere noted at: Kūvallē Incline (ca. 1,000 ft.—Cochin Forest Tramway); Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris dark brown; upper mandible brown, lower mandible pale flesh-colour; mouth yellow and pink; legs and feet brownish-plumbeous; claws horny-brown.

[Other specimens examined:

B. M. Coll.: o? 27-11-74, o? 4-12-78, o? no date Mynall (Bourdillon); ♀ -12-90 Ponmūdi (Ferguson).

The Survey ♀ measures:

Bill.	Wing.	Tail.
14.5	75.5	56 mm.—H. W.]

Apparently this Flycatcher is an uncommon winter visitor to the area. All the specimens I came across were on the outskirts of evergreen forest, by traces and clearings, between 2,000 and 3,500 ft. elevation.

It has not been recorded from the Pālni Hills or Ceylon, though it doubtless occurs in the former.

Alseonax muttui muttui (Layard). Layard's Flycatcher.

Specimens collected: 128 o? 23-1-33, 151 ♀, 152 ♀ 25-1-33 Sānthanpāra 3,500 ft.; 212 ♀ 4-2-33, 231 ♂ 7-2-33 Thattākād 200 ft.; 292 ♂ 16-2-33 Ūrūmbikera Res. Forest ca. 1,000 ft.; 877 ♂ 17-11-33 Kūriārkūtti 1,600 ft.; 999 ♂ 20-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Peermade (3,200 ft.); Rājampāra (1,350 ft.—Pandalam Hills).

Colours of bare parts: Iris dark brown; upper mandible dark horny-brown, lower mandible pale flesh colour; mouth yellow (in two examples with a pinkish tinge); gape in the same two yellow; claws dusky.

[Other specimens examined:

B. M. Coll.: ♂ 18-11-74, ♀? 14-1-76, o? no date Mynall (Bourdillon); ♀ 29-12-85 Chimpani, Travancore-Tinnevelly boundary (William Davison).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	16-17.5	72-74.5	49-53.5	13.5-14 mm.
3 ♀♀	16-17	70.5-72.5	51-54.5	13.5-14 mm.—H. W.]

Layard's Flycatcher is a common winter visitor to Travancore and Cochin. The last date I noted it on was 17 March. By the time the next suitable locality was visited—22 April—the species had completely disappeared. Not a single specimen was observed in the subsequent five days inspite of the special look-out which was kept.

Although examples were obtained as low down as 200 ft. elevation, the bird was commonest on the hills between 1,000 and 3,500 ft. It was inseparable from evergreen forest tracts, frequenting the dense scrub and liana tangles, preferably on the fringe of jungle, and cardamom clearings where the bare branches of the felled trees, their stumps and other brushwood littering the hillsides provided admirable bases for its sallies after winged insects. The vicinity of rocky wooded streams also constituted a favourite haunt. The bird was invariably met singly, but frequently in loose association with *Eumiyas*, *Culicicapa*, *Tchitrea* and other flycatchers.

It has evidently not been recorded from the Pālni Hills and its status in Ceylon is the same as in Travancore, i.e. winter visitor.

William Davison (*Ibis*, 1888, pp. 146-7) obtained 4 males 'late in December or early in January' on Chimpani Hills dividing Travancore territory from the Tinnevelly District.

The gonads of all the specimens were undeveloped and so far we have no evidence in support of the suggestion in the *Fauna* (ii, 252) that it will most probably be found to be a resident and to breed over much of its 'supposed' winter habitat on mountains of sufficient height.

Ochromela nigrorufa (Jerdon). The Black-and-Orange Flycatcher.

Specimens collected: 103 ♂ 17-1-33 Mūnnār 5,000 ft.; 330 ♀ 22-2-33 Peermade 3,200 ft.

Elsewhere noted at: Sānthanpāra (3,500 ft.); Camp Derāmalāi (at ca. 4,500 ft.).

Colours of bare parts: Iris brown; bill blackish-brown; mouth brownish-pink (No. 103 ♂), pale pink (No. 330 ♀); legs, feet and claws greyish-brown (No. 103), greyish-flesh (No. 330).

[Other specimens examined:

B. M. Coll.: ♂ 7-4-80 Travancore-Tinnevelly boundary 3,600 ft. (Bourdillon); ♂ no date Pālnis (Fairbank).

B. N. H. S. Coll.: ♂ 29-3-94 Kodaikanal (J. P. Cook).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂	13-13.5	61-63	49-51	18.5-20 mm.
1 ♀	13	58.5	44.5	18.5 mm.—H. W.]

The Black-and-Orange Flycatcher is essentially a bird of dense evergreen forest. According to Ferguson (*J.B.N.H.S.*, xv, 464) it is 'common on the High Range and at elevations of 3,500-4,000 ft. in the south'. I did not come across it either in the Ashāmbū Hills or in the Nelliampathies, neither has Kinloch recorded it from the latter. Where occurring, it was not uncommon between 3,000 and 5,000 ft., being perceptibly more abundant in the neighbourhood of the latter elevation. Below 3,000 ft. it was not observed.

The bird frequents the Eeta facies or flits about amongst the dense undergrowth of seedlings, *Strobilanthes*, *Pandanus* or *Calamus* singly or in pairs, the male uttering a somewhat metallic high-pitched *chiki-riki-chiki* or *chee-r-ri-ri* every few seconds. It is not shy and does not resent observation at close quarters provided one remains motionless. At Mūnnār I frequently saw it by the roadside near the workshop, the noise within and the motor traffic without not seeming to disturb it at all.

In the Pālni Hills it is said to be the commonest of the flycatchers at higher elevations. Fairbank (*S.F.*, v, 401) observed it in groves at the top of the hills and also at Shemiganūr (5,500 ft.) in dense thickets.

The species does not extend into Ceylon.

Breeding: The gonads of the survey specimens showed no departure from the normal non-breeding condition. The breeding season in Travancore is stated (*Nidification*, ii, 221) as March and April. Both Bourdillon and Stewart took nests at between 3,000 and 4,000 ft. elevation. They are said to be nearly always built of Eeta (*Ochlandra*) leaves and from a few inches to about 4 ft. from the ground, but usually between 2 and 3 ft. Two eggs is said invariably to be the full clutch.

Culicicapa ceylonensis ceylonensis (Swainson). The Grey-headed Flycatcher.

Specimens collected: 50 ♀ 10-1-33 Marāiyūr 3,500 ft.; 415 ♂ 7-3-33 Kūmili 3,000 ft.

Elsewhere noted at: Kūmarikkāi Malāi (7,000 ft.); Sānthanpāra (3,500 ft.); Camp Derāmalāi (3,000 ft.); Ashāmbū Hills (only at ca. 3,500 ft. and above!); Kūriārkūtti (1,600 ft.); Pādagiri (3,000 ft.—Nelliampathy Hills).

Absent at Thattākād (200 ft.)!

Colours of bare parts: Iris dark brown; upper mandible horny-brown, lower mandible pale yellowish-horn; mouth yellow; legs and feet brownish-orange; claws horny-brown; soles bright orange.

[Other specimens examined:

B. M. Coll.: ♂ ?-2-92 High Range (A. N. Nair).
Sparrow Coll.: ♀ 10-3-14 Cardamom Hills.
B. N. H. S. Coll.: ♂ 30-12-93 Chimunji (Ferguson).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
3 ♂♂	13	64-66	53.5-57	— mm.
2 ♀♀	12.5-13	59-63	50-54	13 mm.—H. W.]

This little Flycatcher was commonly met with by the Surveys in hilly, forested country between 1,500 and 7,000 ft. It appeared to be inseparable from evergreen forest, but presumably inhabits the higher hills only as at Thattākād (200 ft.) it was absent and significantly enough I have no record either from Tenmalāi (500 ft.) or Rājampāra (1,350 ft.). Ferguson (*J.B.N.H.S.*, xv, 465) described it as 'common on the High Range and on the tops of the hills in the south'.

It frequents sholas on the hillsides and along ravines, and also opener secondary growth on their outskirts and bamboo forest, especially the vicinity of streams and torrents. Along the trace from Kūmili to Wūndamet (Cardamom Hills) over open grassy undulating hills (ca. 3,500-4,000 ft.), little sholas appear from time to time in dank ravines, often barely a couple of acres in extent, and separated from the next by a mile or more. Each of these wooded dells invariably harboured a couple or so of Grey-headed Flycatchers, and here as elsewhere they were mostly observed in association with *Phylloscopus occipitalis* and other small bird species, acting as outriders to the foraging assemblies and snapping up any winged insects escaping from their concerted hunt among the foliage.

In my experience the commensalism between this Flycatcher and *Phylloscopus occipitalis* is a fairly constant feature. I have observed them in company almost invariably, not only in Travancore and Cochin but also in the Nilgiri and Biligirirangan Hills of South India. It is noteworthy that the only occasion on which I came across this Flycatcher in the Hyderābād State it was also in association with a flock of *Phylloscopus occipitalis*.

A pretty little 'song' of 5 whistling notes—*chick! whichee whichee?* (accent on last 2, which end interrogatively)—is constantly uttered in between the short, graceful twisting sallies after flies, gnats etc. and is surprisingly loud for the size of the bird.

In the Pālni Hills, Fairbank (*S.F.*, v, 401) found it common in Kodaikanal as well as in groves 'lower down'—to what elevation is not mentioned.

In Ceylon it is a resident form above 1,000 ft.

Breeding: The testes of No. 415 (7 March) were in non-breeding condition, although the ovary of No. 50 was distinctly granular on 10 January.

The breeding of this species has apparently never been recorded in the Travancore-Cochin area. The season over the whole of its range is said to be April, May and June (*Fauna*, ii, 255).

Tchitrea paradisi leucogaster (Swainson).

Specimen collected: 34 ♂ 7-1-33 Marāiyūr 3,500 ft.

Tchitrea paradisi paradisi (L.). The Paradise Flycatcher.

Specimens collected: 202 ♂ 3-2-33 Thattākād 200 ft.; 395 ♂ 3-3-33 Kūmili 3,000 ft.; 600 o? 16-4-33 Arāmboli 250 ft.; 865 ♂ 14-11-33 Kūriārkūtti 1,600 ft.; 900 ♀ 25-11-33 Wadakkāncheri 400 ft.; 958 ♀ 8-12-33 Nemmāra 300 ft.

Elsewhere noted at (races uncertain): Kottāyam (ca. S.L.); Ūrūmbikera Res. Forest near Mūndakāyam (ca. 1,000 ft.); Rājampāra (1,350 ft.); Tenmalāi (500 ft.); Trivandrum (S.L.); Pādagiri (3,000 ft.—Nelliampathies); Trichūr, Karūpadanna (S.L.).

Colours of bare parts: Iris dark brown; bill greyish-blue, blackish at extreme tips; mouth greenish-yellow or bright yellow (202); gape and eyelids slaty-blue; legs and feet greyish-blue; claws brown.

[No. 34, although it is slightly darker than many specimens of *leucogaster*—but not all—and has the longer tertiaries black and white which is unusual, must I think be referred to this race as it has the primaries, secondaries, primary coverts and bastard wing black and white. This is a slight southerly extension of the known winter range of this form. The streamers vary *inter se*. One is chestnut; the other is chestnut but has the outer web almost entirely white and there is some white mottling on the inner web. It measures: Bill, 23; Wing, 98.5; True Tail, 108; Streamers, 256 mm.

As I have already pointed out in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, 89) there must be some satisfactory explanation of the curious status and migrations of the Paradise Flycatcher in Ceylon as described by Legge on theories that are hardly convincing; and the most obvious explanation would seem to be that there is a resident short-tailed race in the island in which the white phase is eliminated. This point can however be settled only by careful field work in the island and I have seen no evidence for the supposedly richer colouration of the females and young—as compared with the typical form—on which Mr. Stuart Baker (*Nidification*, ii, 236) now accepts a race *T. p. ceylonensis* for 'Ceylon and the extreme south of Travancore'. The Survey series shows no difference between birds from the extreme south and the rest of Travancore, nor can I separate them from the typical form.

Measurements:

	Bill.	Wing.	True Tail.	Streamers.	Tarsus.
No. 865 red ♂ with red streamers	25	96	107.5	254	17 mm.
Nos. 202, 395 ♂ like ♀	24-25.5	86-87.5	95-96.5	—	16 mm.
Nos. 900, 958 ♀ ♀	23.5	89.5-92.5	101-112	—	— mm.

—H. W.]

During the period the Surveys were in the field—November to April (both inclusive)—the Paradise Flycatcher was noted as a fairly common though perhaps not numerically abundant species throughout the area from the coast upto—with the exception of Marāiyūr (3,500 ft.) and Pādagiri (3,000 ft.)—about 1,500 ft. in the hills. It was, however, commonest in the low country under 1,000 ft. Mr. Pillai, who collected in the environs of Trivandrum town in July and August informs me that inspite of special effort he failed to meet any Paradise Flycatchers there during that period. Ferguson mentions (*J.B.N.H.S.*, xv, 465) that in the 'dry weather' [February-March?] it ascends the hills to considerable elevations. He procured specimens at 6,000 ft. on the High Range and also on the summit of the hills in the south (i.e. 3,500-4,000 ft.).

The bird was met with singly as a rule in mixed bamboo forest, on the fringe of evergreen jungle, in rubber plantations and groves of large trees as also in the jack-fruit and cashew gardens surrounding homesteads along the backwaters.

In evergreen patches it was commonly observed in association with *Dendrocitta leucogastra, Dissemurus paradiseus, Hypothymis azurea, Phylloscopus occipitalis, Culicicapa* and the other usual members of localised hunting parties.

On one occasion while walking through evergreen undergrowth in forest at Thattākād, I noticed a male in red plumage fluttering about helplessly among the leaves on the ground, unable to fly. Examination showed that the flight feathers of one wing had become pinioned by a bunch of hooked seeds of the grass *Streptogyne crinita* Beauv. When the tangle was removed, the bird flew off. This suggests that accidents of this kind must not infrequently befall birds descending to the ground to pick up insects etc. since in places the grass is not uncommon.

I do not think much significance need be attached to Kinloch's statement that in the Nelliampathies males in white plumage preponderate over females or red males. White males are certainly more conspicuous wherever they are, and it may even be that at the period Kinloch made his observation there may have been a migrational wave of white males. In many bird species the sexes migrate separately, and for all we know the Paradise Flycatcher may well be one of them. I myself have noted that at Nemmāra (8 December) red plumaged males and females were common, but white males exceedingly rare.

In the Pālnis, it appears to be uncommon. Fairbank (*S.F.*, v, 401) observed a single 'young one' [red?] at the base of the hills and Terry met another single bird at Pulungi.

The typical race occurs in Ceylon, but see Mr. Whistler's remarks *supra*.

Breeding: The gonads of all the survey specimens were undeveloped and gave no indication as regards breeding. *Nidification* (ii, 236) mentions Mr. J. Stewart taking a nest with 3 eggs in the extreme south of Travancore on

14 March, and this probably constitutes the only record we have of the breeding of the Paradise Flycatcher in our area.

Hypothymis azurea styani (Hartlaub). The Indian Black-naped Flycatcher.

Specimens collected: 48 o? imm. 9-1-33 Marāiyūr 3,500 ft.; 136 ♂ ad. 23-1-33 Sānthanpāra 3,500 ft.; 394 ♂ ad. 3-3-33 Kūmili 3,000 ft.; 891 ♂ ad. 21-11-33 Kūriārkūtti 1,600 ft.

Elsewhere noted at: Thattākād (200 ft.); Ūrūmbikera Forest near Mūndakāyam (ca. 1,000 ft.); Rājampāra (1,350 ft.); Tenmalāi (500 ft.); Wadakkāncheri (400 ft.).

Colours of bare parts: *Adult male*: Iris dark brown; bill bright blue with blackish tips; mouth greenish- or sulphur-yellow; legs and feet slaty-blue; claws brown. *Immature* (No. 48): Iris dark brown; upper mandible horny-brown, lower mandible brownish-grey; mouth yellow; legs and feet blackish-slate; claws brown.

[Further specimen examined:
Brit. Mus. Coll.: ♂ 11-2-75, ♂ no date Mynall (Bourdillon).

Measurements:

	Bill.	Wing.	Tail.	Tarsus.
5 ♂♂	14-15	66.5-74	65-74	16 mm.

These specimens, together with additional ones that I have examined from N.-E. India, confirm my action (*J.B.N.H.S.*, xxxvi, 91) in not accepting two races in India.—H. W.]

The Black-naped Flycatcher was met with in well-wooded country at all elevations between 200 and 3,500 ft., and was not uncommon in the localities recorded.

Dense bamboo forest, the lofty shade trees of cardamom plantations, evergreen sholas and opener teak plantations all appeared to attract it equally, and single birds or pairs were frequently to be found in the localised bird associations in all these facies. As a rule they kept to taller trees than other flycatchers did, flitting about amongst the sprigs and foliage or spreading and partly erecting the tail and pivoting on their perch from side to side to the constant accompaniment of a lively high-pitched *chee-chwee.*

So far it has evidently not been recorded from the Pālni Hills.

In Ceylon, the race *H. a. ceylonensis* is endemic to the Island.

Breeding: The specimens showed no gonadal development. No. 48 (9 January) was immature (in first winter plumage) with a soft skull, suggesting that it had been bred late in the year. No records of its breeding in the Travancore-Cochin area are available, but in the Nilgiris the usual breeding season is said to be June and William Davison found a nest with newly hatched young as late as 28 August.

Leucocirca aureola compressirostris Blyth. The Southern White-browed Fantail Flycatcher.

Specimens collected: 312-313 ♂ ♀ 19-2-33 Kottāyam ca. S.L.; 682 ♀ 17-7-33 (Pattom), 719 ♀ 24-7-33 (Thirūmalāi 100 ft.), 730 o? 26-7-33 (Kūttāni 300 ft.), 755 ♂ 31-7-33 (Akkūlam 150 ft.), 796 o? 6-8-33 (Pūlayanār Kotta 200 ft.), 857 ♀ 14-8-33 (Golf Links 100 ft.) Trivandrum Environs; 936 ♀ 4-12-33 Nemmāra 300 ft.; 1015 ♂ Karūpadanna ca. S.L.

Elsewhere noted at: Chālakūdi, Trichūr.

Colours of bare parts: Iris brown; bill brownish-black; mouth pink; legs, feet and claws blackish-brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
2 ♂♂	15	85-87	86.5-91.5	18 mm.
5 ♀♀	13.5-15	80-81	83-86	17-18.5 mm.

The alleged difference between the birds of North and South Travancore given in the *Fauna* (ii, 279) has already been shown (*J.B.N.H.S.*, xxxvi,

92) to be incorrect, and that decision is again confirmed by the survey series. All the birds belong to the one race *compressirostris* and exhibit the characteristics defined in the Eastern Ghats Survey paper.—H .W.]

This Fantail Flycatcher is, as stated by Ferguson, common in the low country in both the States, and the Surveys did not meet it in the hills at all. This is rather curious since Dewar (*J.B.N.H.S.*, xvi, 154) considered it very numerous at Coonoor (5,500 ft.—Nilgiris) and Fairbank (*S.F.*, v, 401) found it up to 4,000 ft. in the Pālni Hills. However, as both these authors omit *pectoralis* from their lists doubt has been cast upon the correctness of their identifications. I personally found *pectoralis* sparingly at Kotāgiri (6,300 ft.—Nilgiris) while up there between July and December (1932), but have only one unconfirmed record of hearing *aureola* (at about 6,000 ft.) on 9 August.

Its favourite haunts in Travancore and Cochin are the mango, cashew and jack-fruit gardens surrounding the homesteads along the backwaters, and wooded compounds in towns. It also frequents groves of large trees such as mango and tamarind preferably in the neighbourhood of human habitations, and to a lesser extent light secondary and scrub jungle.

It is a resident species in Ceylon.

Breeding: Nos. 312 and 313, a pair (19 February) were breeding. The testes of the ♂ measured 8×5 mm., while many of the ovarian follicles of the ♀ were over 1 mm. in diameter. The pair were hopping about on the ground collecting cobwebs spun across furrows and also fibres from a decayed cocoanut palm trunk. No. 936 (4 December) with granular ovary, was one of a pair observed in copula.

According to Ferguson, this Flycatcher breeds in Travancore in April, but from my experience it is evident that it commences doing so considerably earlier. Three of the specimens obtained by Pillai in July and August (Nos. 719, 730 and 755) were immature with imperfectly ossified skulls and all of that period were undergoing heavy post-juvenal or post-nuptial moult.

Leucocirca pectoralis was not met with by the Surveys in the Travancore-Cochin area at all, and one would like to know on what evidence the distribution as given in the *Fauna* (ii, 282) is based.

FAMILY: LANIIDAE.

Lanius vittatus Valenciennes. The Bay-backed Shrike.

Specimens collected: 613 ♂ 18-4-33, 626 ♂ 19-4-33 Arāmboli 250 ft. Elsewhere not noted.

Colours of bare parts: Iris brown; bill black; legs and feet dark slaty-brown; claws horny-black.

[No other specimens from Travancore seen. The 2 ♂♂ measure:

Bill.	Wing.	Tail.	Tarsus.
18	83.5-84.5	84-88.	22-22.5 mm.

I have now seen enough specimens to be able to say something about the plumages. The sexes of this shrike are alike in colour and size and there is no difference in summer and winter plumage. In the adult there is no spring moult and the autumn moult takes place from July to December beginning with the wings and tail, by which time the body plumage is often in very worn condition. The immature male and female are also of the same size, but the wing and tail are slightly shorter than in adults. The post-juvenal moult takes place about August to November and I have seen it only just beginning as late as 21 December (Mhow). In this are moulted the body plumage, the tertiaries, a variable number of wing-coverts (usually, however, all but the primary coverts with their corresponding smaller coverts) and a variable number of tail feathers (sometimes only the central pair, sometimes all but the two outer pairs).

The first winter plumage is variable. It is normally a slightly duller edition of the adult plumage save for the unmoulted parts of the wings and tail. The black frontal band may, however, be absent, variegated black and grey or suggested merely by one or two black feathers. The broad band through the eye from lores to ear-coverts may be rich brown instead of black. The nape, hindneck and mantle may be washed with ashy-grey or more rarely with chestnut. The sides of the breast are sometimes marked with bars and crescents.

When the fully adult plumage is assumed is not clear. Some birds certainly breed in the first winter plumage, but others perhaps moult it before breeding as I have seen a young female with wing and body moult on 5 March.—H. W.]

The Bay-backed Shrike was met by the Surveys at Arāmboli only, and here it was rare. The Arāmboli Gap is a break in the line of the Ghats and forms the thoroughfare between Travancore State and the adjoining Madras district of Tinnevelly. Through this pass several of the typically plains forms wander in. I have already suggested this as the explanation for the highly probable occurrence of *Argya caudata* at Arāmboli, and I consider it more than likely that the presence of the Bay-backed Shrike within Travancore territory is attributable to the same cause. Ferguson also found this species only about Cape Comorin where it had doubtless wandered in from the arid adjoining Madras district unobstructed by the barrier of hills.

The birds were met singly or in pairs frequenting the open scrub country about the bases of the bare rocky hills flanking the 'gap'.

The statement in the *Fauna* (ii, 290) that it occurs in North Travancore needs confirmation. On what authority its alleged occurrence in the Pālni Hills rests is also not known.

It is not found in Ceylon.

Breeding: The testes of both Nos. 613 (18 April) and 626 (19 April) were enlarged to 5×4 and 7×5 mm. respectively and from this, coupled with their fresh plumage, it was evident that they were preparing to breed. The statement in *Nidification* (ii, 257) that 'in Travancore they breed frequently in February and March' conveys the impression that the birds are common in this area, which is the opposite of the case.

Lanius schach caniceps Blyth. The Southern Grey-backed Shrike.

Specimens collected: 67 ♀ 12-1-33 Marāiyūr 3,500 ft.; 910 ♂ 27-11-33 Wadakkāncheri 400 ft.

Elsewhere not noted.

Colours of bare parts: Iris brown; bill horny-black, plumbeous at base of lower mandible and at chin; mouth pale pink; legs, feet and claws blackish-brown.

[The two specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
♂	22.5	92.5	118.5	27.5 mm.
♀	19	93.5	116	28 mm.

Other specimens examined:

B. M. Coll.: ♂ juv. 1-6-77 Shemiganūr 5,000 ft.—Pālnis (Fairbank), ♀ juv. 8-6-77, ♀ 9-6-77 Kodaikanal, Pālnis (Fairbank); ♂ 17-6-77 Lower Pālnis 4,000 ft. (Fairbank).

B. N. H. S. Coll.: ♂ juv. 8-5-93 Kodaikanal (J. P. Cook).—H. W.]

The Grey-backed Shrike is patchily distributed in the Travancore-Cochin area. I came across it only in the above two localities, fairly common at Marāiyūr and somewhat less so at Wadakkāncheri. Ferguson, however, describes it as not uncommon in the plains and says that it also ascends the hills. He had specimens shot in the High Range in February and March.

The birds were met with singly perched on stumps, hedges, bushes and the like in the neighbourhood of cultivation, fallow land or forest clearings. I cannot say if it is a local migrant or a resident species in the area having come across it here only in the cold weather, neither do Ferguson's remarks (*J.B.N.H.S.*, xv, 459) throw any light on the point. Kinloch mentions it as common in the Nelliampathy Hills of Cochin but is silent as to its status there. As Kinloch's list, however, does not include *Lanius cristatus* which, in the cold weather, is certainly the commonest shrike in this region I am inclined to suspect that there may perhaps have been some error in his identification. This presumption is further strengthened by the fact that both at Nemmāra (foot of Nelliampathies) and at Pādagiri (3,000 ft. up) the Survey failed to meet this species but on the other hand found *cristatus* quite common.

It is apparently a resident in the Pālni Hills and said to breed there from February to July, though May and June seem to be the best time for eggs (Hume, *N.* & *E.*, 2nd edition, i, 323-5).

In Ceylon, this shrike is restricted to the Jafna Peninsula and the northwest of the Island.

Breeding: Neither of the Survey specimens showed any gonadal development. According to the *Fauna* (ii, 297) the breeding season in Travancore is March and April; Stewart is said (*Nidification*, ii, 269) to have taken a fine series of eggs in April and May.

Lanius cristatus cristatus Linnaeus. The Brown Shrike.

Specimens collected: 6 ♂ 4-1-33 Marāiyūr 3,500 ft.; 275 ♂ 12-2-33 Thattākād 200 ft.; 327 ♂ 21-2-33 Peermade at 4,000 ft.; 582 ♀ 12-4-33 Cape Comorin; 598 o? 15-4-33 Arāmboli 250 ft.; 888 ♂ 21-11-33 Kūriārkūtti 1,600 ft.; 962 o? 9-12-33 Nemmāra 300 ft.

Elsewhere noted at: Mūnnār (5,000 ft.); Sānthanpāra (3,500 ft.); Kūmili (3,000 ft.); Camp Derāmalāi (3,000 ft.); Rājampāra (1,350 ft.); Tenmalāi (500 ft.); Balamore Estate (2,000 ft.—Ashāmbū Hills); Chālakudi and all along Cochin Forest Tramway; Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: Iris brown; bill, upper mandible and tip of lower horny-brown, rest of lower mandible creamy flesh colour; mouth pale flesh-pink; legs and feet slaty-brown; claws brown.

[Measurements:

	Bill.	Wing.	Tail.	Tarsus.
4 ♂♂	18.5-19	86-89	78-86	24-25.5 mm.
1 ♀	18.5	moult.	77.5	— mm.

In the Survey series the length between the tips of the outer tail feather and the longest tail feather varies from (15) 18-22 mm. Nos. 6, 275, 582, 598 and 962 are adult, the others are not.

In this race the sexes are alike. The amount of rufous wash on the lower parts is variable, a matter merely of individual variation. First winter birds may be recognised from adults by:

(1) the band through the eye from the lores to the ear-coverts is brown not black. (Occasional adults may have the band brown.)

(2) there is less white about the forehead and supercilium,

(3) the much greater amount of crescentic barring on the lower parts,

(4) the retention on the wing-coverts and tertiaries of a certain number of juvenile feathers.

The first winter plumage is probably changed for the fully adult plumage in the first spring.

Adults have a complete moult in both spring and autumn, which takes place in the winter quarters. Summer and winter plumage is alike.—H. W.]

The Brown Shrike is a winter visitor to South India as it is to Ceylon, arriving in early September and leaving towards the end of April. In the Travancore-Cochin area it is common and very generally distributed both in the hills up to at least 7,000 ft. (Kūmarikkāi Malāi !) and throughout the low country. Ferguson seems to have found it mostly from about 2,000 ft. elevation upwards and he considered it rare in the low country. By 27 April, which is the last record I have, its numbers had noticeably decreased.

It was observed singly in every type of country ranging from cultivation and dry scrub or mixed bamboo jungle to the fringe of evergreen forest and often considerable distances within, along cart traces and the like. A favourite haunt is the open grass-covered hillsides dotted here and there with clumps of stunted date palms (*Phœnix farinifera*) which provide useful lookout posts as well as shelters from the heat of the day. The birds were everywhere shy and difficult to approach.

At Marāiyūr and Wadakkāncheri this shrike and the foregoing were frequently found side by side, and their numbers here were about equal.

The harsh call *chr-r-r-ri* etc. is easily distinguishable from the similar notes of the Grey-backed Shrike.

Hemipus picatus picatus (Sykes). The Black-backed Pied Shrike.

Specimens collected: 464 ♂, 465 o? juv. 18-3-33, 473 ♀ 20-3-33 Rājampāra 1,350 ft.; 968 ♀ 12-12-33, 983 ♂ 15-12-33 Pādagiri 3,000 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Sānthanpāra (3,500 ft.); Peermade (3,200 ft.); Kūmili (3,000 ft.); Camp Derāmalāi (3,000 ft.); Tenmalāi (500 ft.); Balamore Estate (2,000 ft.—Ashāmbū Hills); Kūvalle Incline (Cochin Forest Tramway).

Colours of bare parts: *Adult*: Iris yellowish-brown; bill horny-black; mouth slaty-pink; legs, feet and claws blackish-brown. *Juvenile* (No. 465): Iris brown; bill horny-brown; mouth yellowish-pink; legs and feet pinkish-brown; claws horny-brown.

[Measurements:

	Bill.	Wing.	Tail.
3 ad. ♂♂	15-16	62-64	57-58 mm.
1 ♀	16.5	62.5	61 mm.

No. 473 is marked as a female with the organs undeveloped. By its glossy black back I should have unhesitatingly considered it an adult male, females and first winter males in other parts of India having a brown back as in No. 968. It is however remarkable that Legge states and in this he is followed by Wait, that in Ceylon the female—and so, therefore, I presume the first winter male—is black-backed like the male. If this is correct, it would certainly be grounds for the recognition of a separate race. Seven skins from Travancore in the British Museum are all black-backed and one of these is labelled ♀.

The adult bird undergoes a complete post-nuptial moult, but there is apparently no pre-nuptial moult.

The juvenile (No. 465) is similar to the brown-backed female but the upper plumage is more a chocolate brown in colour, with some of the feathers lightly edged with white; median and greater coverts dingy white, with subterminal brown bars and other irregular markings; tertiaries edged with dingy white; lower plumage white washed with brown on the breast and flanks. Tail feathers narrower and more pointed than in adult.—H. W.]

The Pied Shrike is, as Ferguson suggests, common in Travancore and this description applies equally to its status in Cochin. The Surveys came across it only between 500 ft. and 3,500 ft. elevation, but it doubtless also occurs higher up. Its favourite haunts are thinned cardamom sholas, the fringe of evergreen jungle or more precisely the transition zone between evergreen and deciduous forest. I did not meet with it in open scrub and bush country either in Travancore or Cochin. The birds move about in pairs or family parties of 3 to 5. In habits they resemble both the Wood-Shrikes (*Tephrodornis*) and the flycatchers, the members following each other from tree to tree, searching among the foliage and sprigs for insects or capturing winged prey by launching graceful sallies after it, turning and twisting in mid-air with great agility. The notes frequently uttered—*whi-ri-ri*, *whi-ri-ri*, *whi-ri-ri-ri* etc.—are very reminiscent of a cheap, squeaky cracker whistle!

In the Pālni Hills, Fairbank records meeting a few; in Ceylon the species is widely distributed.

Breeding: No. 465 (18 March) was a juvenile with very poorly ossified skull and undergoing post-juvenal body moult: the rectrices and remiges were unaffected. No. 464, an adult ♂ from the same family party and evidently parent of the foregoing, had a prominent incubation patch on the abdomen suggesting that both sexes partake in the brooding.

The gonads of the specimens gave no indication as regards the breeding season, all being in normal undeveloped condition.

Tephrodornis gularis sylvicola Jerdon. The Malabar Wood-Shrike.

Specimens collected: 36-37 ♂ ♀ 9-1-33 Marāiyūr 3,500 ft.; 127 ♂ 22-1-33 Sānthanpāra 3,500 ft.; 892 ♂ 21-11-33 Kūriārkūtti 1,600 ft.; 982 ♂ 15-12-33, 996 ♀ 19-12-33 Pādagiri 3,000-4,000 ft.

Elsewhere noted at: Thattākād (200 ft.); Ūrūmbikera Reserve Forest near Mūndakāyam (ca. 1,000 ft.); Kūmili and Periyār Lake Environs (3,000 ft.); Camp Derāmalāi (3,000 ft.); Rājampāra (1,350 ft.); Tenmalāi (500 ft.); Balamore Estate (2,000 ft.—Ashāmbū Hills); Wadakkāncheri (400 ft.).

Colours of bare parts: Iris lemon- or greenish-yellow; bill horny-black; mouth greyish-pink (36 and 126), pale creamy yellow and pink (892, 982 and 996); legs and feet plumbeous; claws brown. In No. 37 iris khaki; bill pale horny-brown, paler at gape and chin; mouth greyish-pink; legs, feet and claws as in the others.

[Other specimens examined:
B. M. Coll.: ♀ 18-5-77 Painkadu, 4,000 ft., Lower Palnis (Fairbank).
B. N. H. S. Coll.: ♀ 17-6-93 Palnis (J. P. Cook).

The Survey specimens measure:

	Bill.	Wing.	Tail.
4 ♂♂	25-26	112-117	79.5-83 mm.
2 ♀♀	26-27.5	114-114.5	81-86 mm.

None of the specimens show any moult. No. 892 is a first year ♂ in the plumage of the ♀ and judging by the size of the organs (5×3 mm.) was about to breed in this plumage.—H. W.]

The Malabar Wood-Shrike is common in all evergreen forest tracts throughout the two States and was met with between 200 ft. and 4,000 ft. elevation. It goes about in parties of 5 to 8 birds among tall trees, taking short sailing flights or 'hops' from branch to branch after insects or launching aerial sallies and loops after them like *Culicicapa,* either returning to the same perch or moving from tree to tree. These antics, lithe and graceful, closely resemble those of the White-bellied Drongo and are pretty to watch. Sometimes a bird will momentarily cling to the bark of a tree and pry into the crevices for a lurking insect, at others deftly swoop down and carry it off in its stride. The birds are commonly seen among the mixed assemblies in forest and as the parties move along through the trees the individuals (males only?) utter from time to time a musical *witoo-witoo-witoo* etc. repeated four to six times in quick succession. One bird was observed to capture a thick hairy caterpillar about 2 in. long, which it battered repeatedly against a branch before swallowing.

Fairbank (*S.F.*, v, 400) apparently found this Wood-Shrike common in the Pālni Hills at about 4,500 ft. on the western (humid) side. It does not occur in Ceylon.

Breeding: The testes of No. 892 (21 November) measured 5×3 mm. but none of the other specimens showed any gonadal development, neither was any other evidence as regards breeding obtained.

According to the *Fauna* (ii, 311) J. Stewart in Travancore and A. P. Kinloch in the Nelliampathy Hills of Cochin took nests with eggs from March to June.

Tephrodornis pondicerianus pondicerianus (Gmelin). The Indian Common Wood-Shrike.

Specimens collected: 16 ♂ imm. 5-1-33 Marāiyūr 3,500 ft.; 256 ♀ 9-2-33 Thattākād 200 ft.; 445 ♂ 16-3-33 Rājampāra 1,350 ft.; 568 ♀ 11-4-33 Cape Comorin (S.L.); 697 ♂ 20-7-33 (Thirūmalāi 120 ft.), 704 ♂ 22-7-33 (Museum and Public Gardens ca. 100 ft.), 732 ♂ 26-7-33 (Kūttāni 300 ft.), 754 ♀ 31-7-33 (Akkūlam 150 ft.), 784 ♀ 4-8-33 (Cattle Farm 150 ft.), 803 ♀ 7-8-33 (Golf Links), 849 ♂ 13-8-33 (Nettayam 300 ft.) Trivandrum Town and Talūka; 939 o? 4-12-33, 946 o? 6-12-33 Nemmāra 300 ft.; 1013 ♂ 26-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Kottāyam (ca. S.L.); Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Trichūr town.

Colours of bare parts: Iris greenish-brown; bill horny-brown, darker at tips; mouth pink or 'pale yellow, grey and pink' (Pillai); legs and feet slaty-brown; claws brown.

[Owing to moult I can only give measurements of part of the series:

	Bill.	Wing.	Tail.
3 ♂♂	21-22	85.5-89.5	61-61.5 mm.
3 ♀♀	20-20.5	80-88	56-62.5 mm.

Inspite of its small range of colours this species is very variable in tint and has yet hardly segregated into races. Birds from Burma, Calcutta, Dacca, Duars, etc., are very dark in colour and so are Travancore birds, whilst those from Sind, Jodhpur, Punjab, etc. are very pale. The latter have been separated as *pallidus* and if compared with these darker birds of the north-east or south-west *pallidus* appears a very good race. Unfortunately by the usual historical accident, the intermediates between the dark and light forms provide the typical race, and compared with it both pale and dark forms appear hardly separable. As *pallidus* is therefore separable with difficulty, there seems no object in providing the dark form also with a name. Travancore birds show some passage with *T. p. affinis* of Ceylon. They are, however, definitely closer to the typical form and should be kept with it.

This species has a complete post-nuptial moult but no pre-nuptial moult. As the post-nuptial moult in Travancore appears to be very regular, about July-August, the breeding season is no doubt well defined.—H. W.]

Except in the case of Marāiyūr (3,500 ft.), the Common Wood-Shrike was met with by the Surveys only in the lower country from the coast inward up to about 1,500 ft. elevation (usually under 500 ft.), where it is common and apparently a resident. It frequents light deciduous jungle or open scrub-and-bush country, being in this respect the opposite of the foregoing species which is largely coincident with evergreen forest. In localities where there is a mixture of the two forest types, both species were present but the predilection of each for its favourite facies was unmistakable. The mango, jack-fruit, cashew and cocoanut gardens which are such a feature of the homesteads along the backwaters, are also amongst its favourite haunts, and it freely frequents gardens and compounds within town limits.

The birds usually move about in parties of 4 or 5 keeping to trees of moderate height, except in the breeding season when pairs is the rule. The males have a call of several pleasant whistling notes *wheet-wheet* followed by a quick repeated interrogative *whi-whi-whi-whi*? besides which some low trills are uttered in the breeding season.

The common Wood-Shrike apparently does not occur on the Pālni Hills, but as in Travancore and Cochin it may do so at low elevations about their base especially on the eastern (drier) side. In Ceylon it is represented by the endemic race *T. p. affinis* 'from the level of the Plains up to 5,000 ft. and occasionally up to 6,000 ft.' (*Fauna,* ii, 313).

Breeding: The ovary of No. 256 (9 February) was distinctly granular; the testes of 445 (16 March) measured 8×5 mm. and the birds were doubtless breeding at this time. On 13 April (Cape Comorin) a pair were observed building in the fork of a Babool tree in open Babool jungle at about 12 ft. from the ground. The birds were tame and did not mind being watched at close quarters. On 16 April (Arāmboli) a nest with 1 fresh egg was located in the fork of an *Albizzia* tree about 30 feet up. The egg disappeared on the 18th. The owners were observed chasing off from the proximity of their abode a Tree-Pie which had its nest in the same compound about 15 yards away and which undoubtedly knew something about the matter! A couple of days later, a Wood-Shrike (presumably one of the outraged pair) was observed gathering cobwebs for a nest in the same neighbourhood.

From the above and from the fact that the specimens collected in July/August were all in post-nuptial moult, it is evident that the breeding season in the Travancore-Cochin area commences about March and may well go on till June as stated in the *Fauna* (ii, 313).

Pericrocotus flammeus (Forster). The Orange Minivet.

Specimens collected: 21-22 ♂ ♀ 6-1-33 Marāiyūr 3,500 ft.; 166-167 ♂ ♂ 26-1-33 Sānthanpāra 3,500 ft.; 329 ♂ 22-2-33 Peermade 3,200 ft.; 410 ♀ 6-3-33 Kūmili 3,000 ft.; 497 ♂ 26-3-33 Tenmalāi 500 ft.; 925 ♂ 30-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Thattākād (200 ft.); Balamore Estate (2,000 ft.—Ashāmbū Hills); Kūriārkūtti (1,600 ft.); Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris brown; bill, legs, feet and claws black ('brownish-slate' in one!); mouth pink, yellowish-pink or 'brown and greyish-pink'; soles of feet yellowish.

[Additional specimens examined:

B. M. Coll.: ♂ ad. 1-6-77, ♂ imm. Shemiganur, Pālnis 5,000-5,500 ft. (Fairbank).

Sparrow Coll.: ♂ ad. 19-3-14, ♂ ad., ♂ imm. 25-3-14 Cardamum Hills.

B. N. H. S. Coll.: ♀ 22-6-93 Pālnis (J. P. Cook).

Also several other Travancore birds in the British Museum.

Travancore specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
6 ad. ♂ ♂	18-19	90-95	87-93	15.5-16.5 mm.
3 imm. ♂ ♂	18.5-20	86-95	88.5-90	16 mm.
3 ♀ ♀	18	91-93	90-96.5	16 mm.

The male in first winter plumage resembles the adult female, but some or occasionally all the yellow of the plumage is a bright orange-saffron tint, quite distinguishable, however, from the flame colour of the adult male plumage.—H. W.]

As recorded for Travancore by F. W. Bourdillon and Ferguson (*J.B.N.H.S.*, xv, 460) the Orange Minivet is common throughout the evergreen forest tracts of the two States from about the low country (Thattāḳād 200 ft.!) up to at least 4,000 ft. in the hills.

The birds move about in small flocks of from 3 to 7 or 8 individuals, keeping mostly to the leafy tops of tall trees where they search for insects among the sprigs or launch graceful flycatcher-like sallies after them into the air. They are usually present amongst the localised bird associations or mixed itinerant hunting parties in secondary jungle. Their call notes (only males?) are similar to those of *Hemipus* but somewhat irregular and, with a little practice, readily distinguishable from the latter.

Fairbank (*S.F.*, v, 400) describes this Minivet as common in the Pālni Hills at all elevations from the bottom to the summits. It occurs in Ceylon in both hills and plains, but birds from the island are possibly smaller.

Breeding: Already as early as 6 January the gonads appeared to have commenced enlarging; in No. 21 the testes measured 4×3 mm. No. 22 on the same date—one of another pair—had some of the ovarian follicles about 1 mm. in diameter. The testes of 166 (26 January) measured 6×4 mm. and it was in immaculate plumage. No. 329 (22 February) also had equally well-developed testes. In the rest of the specimens there was no gonadal development.

On 12 February (Thattākād) a nest was located on the upper side of a thin horizontal branch at the fork near its extremity, of a *Poon* tree (*Calophyllum wightianum*) at a height of about 40 ft. from the ground. The tree stood by the roadside in fairly open deciduous forest on the fringe of evergreen. The ♀ was brooding.

The nest was a shallow cup plastered on the outside with cobwebs and spiders' egg-cases looking exactly like a knot and harmonising perfectly with the lichen-covered bark of the supporting branch. From the behaviour of the birds at this time—males singing excitedly and chasing females through the tree-tops—breeding appeared to be in progress generally, but the season in this area is possibly a protracted one.

In the Pālni Hills it is said to breed in July (*Fauna*, ii, 322).

Pericrocotus roseus roseus (Vieillot). The Rosy Minivet.

Not met with by the Surveys, but Ferguson (*J.B.N.H.S.*, xv, 460) though he never came across it himself, records that his collector obtained 2 specimens at an elevation of 2,500 ft. in South Travancore.

Jerdon (*Birds of India*, i, 423) was informed by Lord Arthur Hay that he had seen this species abundantly in the hills dividing Tinnevelly from Travancore and that collections from Travancore always included it. Inspite of this there seems no doubt that this Minivet must be rare in the Travancore-Cochin area.

Pericrocotus peregrinus malabaricus (Gmelin). The Malabar Small Minivet.

Specimens collected: 84-85 ♀♂ 13-1-33 Marāiyūr 3,500 ft.; 253 ♂, 254 o? juv. 9-2-33 Thattākād 200 ft.; 293 ♂ 16-2-33 Ūrūmbikera Forest 1,000 ft.; 443 ♂ 16-3-33 Rājampāra 1,350 ft.; 716 ♂ 24-7-33 (Marūthānkūzhi 50 ft.), 787 ♂ 4-8-33 (Cattle Farm 150 ft.), 809 ♂ 8-8-33 (Mūkūnnimalāi 800 ft.), 818 ♀ 9-8-33 (Nettāyam 200 ft.) Trivandrum Talūk; 926 ♀ 30-11-33, 927 ♂ 1-12-33 Wadakkāncheri 400 ft.; 959 ♀ imm. 9-12-33 Nemmāra 300 ft.; 1027 ♀ 27-12-33 Karūpadanna ca. S.L.

Elsewhere noted at: Sānthanpāra (3,500 ft.); Kottāyam (ca. S.L.); Kūmili and Periyār Lake Environs (3,000 ft.); Balamore Estate (2,000 ft.); Tenmalāi (500 ft.).

Absent at Cape Comorin!

Colours of bare parts: Iris brown; bill blackish-brown to brownish-black; mouth pale flesh to slaty-pink (in immature gape and mouth pale orange-brick colour); legs, feet and claws blackish-brown to brownish-black corresponding with bill.

[Measurements:

	Bill.	Wing.	Tail.
10 ♂♂	12.5-14.5	69.5-74.5	66-74 mm.
4 ♀♀	13.5-14	71-76	67-70 mm.

The only other Travancore specimens are 3 Anjengo birds in the British Museum.—H. W.]

The Small Minivet of the wet Malabar zone, distinguished from other races by its deeper and richer colouration, is common and generally distributed in the low country throughout the two States and may also be found sparingly in the hills up to at least 3,500 ft. It frequents deciduous or the drier mixed forest, rubber plantations, fruit gardens about the backwater homesteads and the like, usually in small flocks of 4 or 5 birds which move along from tree to tree searching the foliage for insects and uttering a feeble *swee-swee* etc.

In Ceylon it is replaced by *P. p. ceylonensis*, a less richly coloured bird.

Breeding: The testes of No. 253 (9 February) had enlarged to 5×3 mm.; it was undergoing complete (pre-nuptial ?) moult in readiness to breed. On 19 February a pair was observed in courtship which consisted largely of the male chasing the female around, uttering a feeble but excited *swee-swee* in a manner similar to that of *P. flammeus*. No. 959 (9 December) was immature with imperfectly ossified skull and in post-juvenal body moult. No. 1027 (27 December) was in freshly moulted immaculate plumage with ovarian follicles distinctly granular and apparently developing.

The specimens obtained in July and August were certainly either breeding or about to. Their gonads were as follows:

716 (24 July) testes 7×4 mm.; 787 (4 August) testes 6×4 mm.; 809 (8 August) testes 8×4 mm.; 818 (9 August) largest ovarian follicle 4 mm. in diameter. All were undergoing pre-nuptial[1] moult except 809 which had lately completed it. The birds, moreover, were in pairs at this time.

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[1] In this Mr. Whistler hesitates to agree as he considers that most of the minivets apparently have no pre-nuptial moult. He points out that it is parallel to the case of *P. p. pallidus* of which form he has examined 4 specimens in full moult at the time when they actually had eggs in the nest. He is inclined to suggest that a second brood was brought about when the birds were moulting after the first brood, but the point requires further study.

The evidence is somewhat confusing, but clearly indicates that breeding commences in February or earlier and that the season is either much protracted or that there is also a second period later on in the year—July to September or thereabouts.

[**Pericrocotus erythropygius** (Jerdon). The White-bellied Minivet.

Not met with by the Surveys, neither recorded by Ferguson in Travancore, Kinloch in the Nelliampathies nor by Fairbank or Terry in the Pālni Hills.

In the *Fauna* (ii, 333) and *Nidification* (ii, 300), however, Mr. J. Stewart is credited with the taking of its eggs in Travancore. I do not know if the record is supported by skins, but if not I feel tempted to doubt its correctness especially since—like many of his other eggs—these were possibly collected for Mr. Stewart by the Māla Pandāram hillmen.]

Lalage sykesi Strickland. The Black-headed Cuckoo Shrike.

Specimens collected: 23 ♂ 6-1-33 Marāiyūr 3,500 ft.; 457 ♂ 17-3-33 Rājampāra 1,350 ft.; 544 ♂ 9-4-33, 561 ♂ 11-4-33 Cape Comorin (ca. S.L.); 731 ♀ 26-7-33 (Kūttāni 300 ft.), 810 ♀ imm. 8-8-33 (Mūkūnni Malāi 800 ft.), 820 ♀ 9-8-33 (Nettāyam 300 ft.) Trivandrum Talūk; 909 ♀ 27-11-33, 922 ♂ 29-11-33 Wadakkāncheri 400 ft.

Elsewhere noted at: Thattākād (200 ft.); Kottāyam (S.L.); Arāmboli (250 ft.); Nemmāra (300 ft.); Karūpadanna (S.L.).

Colours of bare parts: Iris brown; bill horny-brown, paler (yellowish) at base of lower mandible; mouth pink; legs and feet slaty-brown or slaty-black; claws horny-brown. [Iris of immature (No. 810) 'blue-grey' (Pillai).]

[Additional specimen examined:
B. M. Coll.: ♂ 25-2-80 Quilon (Bourdillon).

The Survey specimens measure:

	Bill.	Wing.	Tail.
3 ad. ♂♂	18.5-20.5	102-109	80-83.5 mm.
2 imm. ♂♂	18-19.5	100-101.5	— mm.
2 ad. ♀♀	18.5-19	100-104	76 mm.
2 imm. ♀♀	18-19.5	98.5-103	77.5-83 mm.

This species has no races but there is a certain amount of individual variation in the adult males in which the abdomen may be dark grey, largely white, or dark grey faintly barred. The young male in first winter plumage resembles the adult female.—H. W.]

The Black-headed Cuckoo Shrike is primarily an inhabitant of the low country in Travancore and Cochin. Marāiyūr (3,500 ft.) is the highest elevation at which I came across it, but it was uncommon there. Col. Sparrow met it in the Cardamom Hills in March, at what elevation it is not stated. Below about 1,000 ft. it is common and frequents light deciduous or mixed forest, fruit gardens about the backwater homesteads and such localities, often in association with the mixed hunting parties of Tree Pies, Babblers, Wood-Shrikes, Grey Tits, Woodpeckers and other birds. It is mainly insectivorous, of course, but at Wadakkāncheri (Cochin) I observed it feeding largely on ripe Lantana berries.

We have no information concerning its seasonal movements in this area, if any, but to all appearances it is a resident species.

In view of what is said in the *Fauna* (ii, 341) about its call, it seems worthwhile to point out that it has a pretty 'song' consisting of several clear whistling notes, ending in a quick-repeated *pit-pit-pit*. This, in my version, is certainly not 'the mere repetition of one plaintive note'.

Fairbank procured a ♂ at Periur in the Pālnis but we do not know anything about its numbers or status in those hills. It is apparently a resident in Ceylon and fairly generally distributed, occurring up to 4,000 ft.

Breeding: No indication is afforded by the specimens except that No. 810 (8 August) was immature with imperfectly ossified skull and in post-juvenal body moult. According to *Nidification* (ii, 306) the breeding season in Travancore is April and May.

Graucalus javensis macei (Lesson). The Large Indian Cuckoo-Shrike.

Specimens collected: 15 ♂ 5-1-33 Marāiyūr 3,500 ft.; 449 ♀ 16-3-33 Rājampāra 1,350 ft.; 718 ♂ 24-7-33 (Pangode 80 ft.), 774 ♀ 2-8-33, 804 ♂, 805 ♀ juv., 806 ♀ juv. 7-8-33 (Golf Links) Trivandrum Environs; 1030 ♂ 28-12-33 Karūpadanna (ca. S.L.).

Elsewhere noted at: Thattākād (200 ft.); Kūmili and Periyār Lake Environs (3,000 ft.); Chālakūdi; Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.—Nelliampathies).

Colours of bare parts: *Adult*: Iris reddish- or orange-brown; bill, legs, feet and claws brownish- or slaty-black; mouth pink. *Juvenile*: 'Iris deep brown; bill slaty, lower mandible paler towards the base; legs ant feet bluish-slate; claws slate; mouth bright reddish-yellow' (Pillai).

[Travancore specimens measure:

	Bill.	Wing.	Tail.	Tarsus.
7 ♂♂	28-29	153-165	111-119	24-25 mm.
4 ♀♀	27-29.5	156-161	108.5-119	23.5-24 mm.

The sequence of plumages has already been detailed in the *J.B.N.H.S.*, xxxvi, 346, so I need only add that adults were undergoing the complete post-nuptial moult in July-August.—H. W.]

The Large Cuckoo-Shrike is a resident in the Travancore-Cochin area, fairly common in the low country up to about 1,000 ft. and somewhat less so upwards to 3,500 ft. which is the highest elevation it was met at. It frequents light deciduous jungle as well as mixed forest on the fringe of evergreen, but seems fondest of rubber plantations and the type of country that obtains around the backwater homesteads. It is usually seen in pairs but also occasionally in small parties of 3 or 4, flying in irregular follow-my-leader fashion above the tree-tops and uttering its distinctive shrill *Tee-eee* calls from time to time.

One of the specimens had captured a large green Mantis.

It appears to be rare in the Pālni Hills. Fairbank (*S.F.*, v, 400) met one at Periur and Terry (*S.F.*, x, 472) came across it in the Pittur Valley. In Ceylon it is represented by the much smaller race *G. j. layardi*.

Breeding: On 7 August (Golf Links, Trivandrum) Pillai found a nest containing 2 fledged young (805 ♀, 806 ♀) ready to leave in 3 or 4 days. The nest was situated in a fork of twigs in a Nim (*Azadirachta indica*) tree at about 25 ft. It is described as 'a neat saucer 4 in. in diameter made of the leaf-stalks of some leguminous tree, fastened together with cobwebs to which were adhering lichens and particles of dry leaves. The bottom of the saucer was strewn with a sort of whitish powdery substance like scales of feather shafts.'

The gonads of all the specimens were in a quiescent state including those of the parent of the chicks (804).

FAMILY: ARTAMIDAE.

Artamus fuscus Vieillot. The Ashy Swallow-Shrike.

Specimens collected: 46-47 ♂♂ 9-1-33 Marāiyūr 3,500 ft.; 517 ♂ 5-4-33 (Velayani Lake), 681 ♀ 16-7-33, 712-713 ♀♂ 23-7-33 (Beach), 750 ♂ 30-7-33 (Veli), 788-789 ♀♀ 5-8-33 (Nettāyam), 840-841 ♂♂ (Beach) Trivandrum Town and Environs; 941 unsexed (in alcohol) 5-12-33, 954 unsexed (in alcohol), 955 ♀ 8-12-33 Nemmāra 300 ft.

Elsewhere noted at: Kottāyam (ca. S.L.); Kūmili and Periyār Lake Environs (3,000 ft.); Cape Comorin; Arāmboli (250 ft.); Wadakkāncheri (400 ft.); Karūpadanna (ca. S.L.).

Colours of bare parts: Iris dark brown; bill bluish-grey, black at tips of both mandibles; mouth slate; legs and feet slate; claws black.

[Measurements:

	Bill.	Wing.	Tail.
3 ♂♂	22.5-23	132-133	52.5 mm.
3 ♀♀	21-21.5	130.5-136.5	55-57 mm.

Moult prevents all the specimens being measured.

Adults undergo a complete moult in July and August.—H. W.]

The Ashy Swallow-Shrike is not uncommon in the low country of Travancore and Cochin, and was also met with sporadically up to 3,000 or 4,000 ft. in the hills. Its favourite biotope, however, is the country along the backwaters, particularly the facies in which *Borassus* and Cocoanut palms predominate. They are usually met gregariously perched on palm trees, telegraph wires and the like whence they fly out from time to time after winged insects, and circle back to their perch. The flight is very swallow-like and consists of several rapid wing beats followed by a graceful effortless sailing.

On a hill at Marāiyūr a congregation of over 30 of these birds was observed all about one particular patch—a glade in mixed bamboo forest. This spot, barely 15 yards square, was discovered to be swarming and alive with thousands upon thousands of the butterfly *Danais melisa dravidarum*. They rested on portions of the foliage of trees in immense clusters that looked exactly like bunches of scorched and withering leaves. Curiously enough, the swarm was confined to this isolated spot and beyond it the species was almost absent. Hundreds of them were preyed upon by spiders—including prominently a *Nephila*—which had spread their webs all over the glade. Whenever the branches were shaken and the shoals of butterflies took wing, the birds descended upon them and wrought destruction. They never took the insects sitting but only hawked them on the wing. Swallow Shrikes were the only bird species interested in these butterflies. Usually when a butterfly is captured in the bill the bird flies back with it to its perch where the wings are pulled off and dropped to the ground before the insect is swallowed, but occasionally this formality is dispensed with and the prey swallowed entire. Frequently the insect is forthwith transferred to the feet, pulled to pieces with the bill and swallowed in mid-air. I also observed that when a swarm of butterflies is on the wing and 'business is brisk', one is caught and promptly transferred to the feet in order that the bill may be free to tackle the second. The bird then flies back to its perch with both its victims and deals with them at its ease.

On the Periyār Lake Swallow Shrikes posted themselves on the dead, partially submerged tree-trunks whence they hawked insects over the surface of the water and also fed largely on butterflies that ventured across from one bank of the lake to the other. Their food seems to consist of butterflies to a very large extent.

In the Pālni Hills Fairbank (*S.F.*, v, 401) obtained this species in thin jungle at 4,500 ft. elevation. It also occurs in Ceylon.

Breeding: The gonads of all the specimens were in normal non-breeding condition, but breeding was obviously in progress in March. On the 4th of that month (Periyār Lake) a pair were observed in copula on a partially submerged tree-stump. The female spread out her wings slightly, gave her body a horizontal stance and 'shivered' in invitation for a second or two. The male flew directly on to her back from a neighbouring perch and balancing himself with his wings completed the act. On 5 April (Trivandrum) a full-fledged young was observed being tended by its parents who beat off a crow encroaching on the neighbourhood.

Pillai's specimen No. 840 (12 August) was evidently not yet fully mature. Its skull was imperfectly ossified, but it was in fresh post-juvenal plumage.

According to the *Fauna* (ii, 349) the Swallow Shrike breeds throughout its wide range during April, May and June, and *Nidification* does not add anything specific for Travancore or Cochin.

FAMILY: DICRURIDAE.

Dicrurus macrocercus peninsularis Ticehurst. The Black Drongo.

Specimens collected: 298 ♂ 17-2-33 Kottāyam (ca. S.L.); 579 ♀, 580 ♂ juv., 581 ♀ juv. 12-4-33 Cape Comorin (ca. S.L.); 676 ♀ 16-7-33 (Beach), 709 ♂ 22-7-33 (Public Gardens), 715 ♂ 23-7-33, 734 ♂ 27-7-33 (Beach), 817 ♀ 9-8-33, 847 ♂ 13-8-33 (Nettāyam 200 ft.) Trivandrum Town and Environs.

Elsewhere noted at: Vadāserikara (near Rājampāra); Arāmboli (250 ft.); Nāgercoil; all along railway line from Shorānūr to Ernakūlam; Wadakkāncheri

(400 ft.); Nemmāra (300 ft.); Trichūr Town and Environs; Karūpadanna; Ernakūlam.

Colours of bare parts: *Adult*: Iris reddish-brown; bill, legs, feet and claws black; mouth slaty-brown and pink. *Juvenile*: Iris brown; bill slaty-black; gape cream colour; mouth bright yellow and pink; legs and feet slate; claws horny.

[Additional specimens examined:

Trivandrum Museum Coll.: ♂ first year 15-9-93, ♀ ad. 27-1-81 Trivandrum.

Measurements:

	Bill.	Wing.	Central Tail.	Outer Tail.
4 ad. ♂♂	23.5-26.5	137-147	90-93	134-168 mm.
2 first year ♂♂	—	134-143	98-109.5	131-150 mm.
4 ad. ♀♀	23-26.5	135.5-144	93-98	147-156.5 mm.

Both Indian races of *Dicrurus macrocercus*, namely *albirictus* (Northern India) and *peninsularis* (Southern India) go through the same plumage stages as follows: The juvenile differs from the adult in having

(1) body plumage softer and browner with very little metallic gloss and that confined to the upper plumage,

(2) wings and tail shorter and duller with less gloss,

(3) underwing coverts edged with white; the outer edge of the secondaries may also be narrowly edged with white.

The post-juvenal moult does not include

(1) primaries, secondaries and tertiaries; primary, greater and sometimes a few median coverts; underwing coverts,

(2) tail.

The first winter and summer plumage is distinguished from adult plumage by

(1) the long upper tail coverts are usually edged with white,

(2) the lower plumage is less glossy, the feathers from the lower breast to the under tail coverts being fringed with white to a variable extent; these gradually wear down and in summer are less noticeable,

(3) the duller more faded appearance of the unmoulted parts of the juvenile plumage, and of course the white on the under wing coverts.

This plumage is kept until the autumn when the first complete moult gives fully adult plumage in the second winter.

Adults have a complete post-nuptial moult. They have the under tail coverts occasionally edged with white, but never so the upper tail coverts or the under wing coverts.

Travancore adults are undergoing their post-nuptial moult in July and August.

For a full revision of Indian members of this species see Ticehurst, *J.B.N.H.S.*, xxxvi, 927-9.—H. W.]

The Black Drongo is one of the most familiar birds in the low country of Travancore-Cochin being invariably present—perched on fence posts, telegraph wires and the like—in the neighbourhood of cultivation. It also frequents gardens and compounds in towns and villages and is very partial to the fruit gardens surrounding homesteads along the backwaters, and to the dyked paddy cultivation in this locality. It was not met with anywhere except in open country—often in association with the localised hunting parties of mixed bird species—and nowhere above about 500 ft. elevation.

One was observed capturing on the wing a cream-coloured butterfly (species?).

It does not ascend the Pālni Hills. In Ceylon it is replaced by the smaller race *D. m. minor* which is endemic to the island.

Breeding: By the middle of February (once also on 10 November—Chālakūdi!) the harsh scolding 'duets' or 'trios' so significant of the breeding season, were in general evidence. No. 298 (17 February) had testes enlarged to 10×5 mm. and was breeding. Nos. 580 and 581 (12 April) were juvenile ready to leave the nest in a day or so. The nest itself was situated at the base of a Palmyra leaf-stalk about 20 ft. up, and these two comprised the full brood, In 579, the mother of the chicks, the ovary was as yet in a conspicuously granular condition and the incubation patch was prominent.

According to T. F. Bourdillon 'eggs may be obtained in any quantities in the low country in June and July' [in Travancore]. He also took eggs in March (*Nidification*, ii, 321).

Dicrurus longicaudatus longicaudatus (Jerdon). The Indian Grey Drongo.

Specimens collected: 14 ♀ 5-1-33, 64 ♀ 11-1-33 Marāiyūr 3,500 ft.; 267 ♂, 268 ♂ 11-2-33 Thattākād 200 ft.; 882 ♀ 18-11-33 Kūriārkūtti 1,600 ft.; 977 ♀ Pādagiri 3,000 ft.

Elsewhere noted at: Peermade (3,200 ft.); Kūmili and Periyār Lake Environs (3,000 ft.); Camp Derāmalāi (3,000 ft.); Nemmāra (300 ft.); Wadakkāncheri (400 ft.).

Colours of bare parts: Iris scarlet or brownish-crimson; mouth greyish flesh colour; bill, legs, feet and claws horny-black.

[Other specimens examined:

Brit. Mus. Coll.: ♀ imm. 11-11-74, ♀ ad. 2-12-78, ♀ ad. 7-12-74, ♂ ad. 7-11-78, ♂ ad. 27-11-78 Mynall, Travancore (Bourdillon).

Trivandrum Mus. Coll.: ♂ 26-12-93 Chimungi; o? -2-99 Ralode [?].

The Survey specimens measure:

	Bill.	Wing.	Central Tail.	Outer Tail.
2 ad. ♂♂	25-25.5	135.5-138.5	89-94.5	149-151.5 mm.
2 ad. ♀♀	25-27	131-138	89.5-92.5	148-148.5 mm.
2 ♀♀ (first winter)	25-26.5	127-127.5	88-89	135-137.5 mm.

In this species the juvenile plumage differs from that of the adult in two important particulars. The body plumage is softer and a browner black, lacking practically all gloss. The wings and tail are as in the adult except for being considerably shorter. The post-juvenal moult does not include the primaries and primary coverts, the secondaries and greater coverts, the tertiaries or tail. These are retained to the following autumn so that first summer and first winter birds differ from adults in their more worn and faded and also shorter wings and tail. They also appear to be slightly paler and less glossy on the abdomen, slight white fringes being more noticeable, especially on the under tail coverts. It is important therefore to remember that in this species the measurements of first year and adult birds must be kept separate if comparison is to be made between the races. This fact has been emphasised by Ticehurst in connection with Burmese birds.

Adults have a complete post-nuptial moult about July-August-September. There is no definite spring moult though odd body feathers are changed.

In *Novitates Zoologicae*, xxv (1918), p. 296, Mr. Stuart Baker named birds from Ceylon as *Dicrurus leucophaeus minimus* on their smaller size. He remarked that 'it appears to be also rather a darker bird than those from Southern India, but the difference is so slight as to be negligible'. The Ceylon bird is, however, a non-breeding migrant, a winter visitor, and in the *Fauna*, vol. ii, p. 364, Mr. Stuart Baker got over this difficulty by fixing the breeding area of *minimus* in the extreme south of Travancore, though in *Nidification*, vol. ii, p. 329, his assurance on this point has weakened. I have seen no evidence that this Drongo is anything but a winter visitor to Travancore, and *D. leucophaeus minimus* appears to me to be based on first year birds of *D. longicaudatus*.—H. W.]

In the hills and wooded areas of the two States, the Black Drongo of the low open country is replaced by this species though I have records only between 13 November and 9 March. It keeps to forest—deciduous, mixed or evergreen—and is especially fond of cardamom sholas and coffee plantations with their shade trees. At Nemmāra and Wadakkāncheri in Cochin, where both the Black and Grey Drongos were found, the former was observed to be restricted to flat open cultivated country while the latter kept to the wooded hills. I cannot confirm Ferguson's statement (*J.B.N.H.S.*, xv, 455) that it is common in the low country of Travancore.

The Grey Drongo is a habitual attendant on the flowers of *Erythrina lithosperma* shade trees and feeds largely on their nectar. Over 10 drops of the fluid dripped from the bill of a specimen when held up by its legs. All specimens shot off these flowers, moreover, had pollen adhering to their forehead and chin, and there is no doubt that this species is instrumental in their cross-pollination.

No. 64 had the outermost pair of tail feathers snow-white!

Breeding: There seems to be great uncertainty as regards the status of this Drongo in our area where it is apparently a winter visitor only. No records of its breeding here exist, and the gonads of the Survey specimens, all in a quiescent state, furnish no clue in this regard.

Dicrurus coerulescens coerulescens (Linn.). The White-bellied Drongo.

Specimens collected: 4 ♂ 4-1-33, 73 ♂ 12-1-33 Marāiyūr 3,500 ft.

Elsewhere noted as absent, but a juvenile dated 27-8-93 from 'Kuranmulti, Travancore' [?] by J. P. Cook is in the B.N.H.S. Collection.

Colours of bare parts: Iris reddish-brown; bill horny-black; mouth greyish-pink; legs, feet and claws blackish-brown.

[There are no Travancore specimens in the British Museum. I think it is by no means certain that *leucopygialis* of Ceylon is a race of this species.—H. W.]

At Marāiyūr—the only locality in the Travancore-Cochin area where this Drongo was met—it was noted as a very common and noisy species, inhabiting mixed bamboo forest especially in the neighbourhood of shady paths and clearings. It was often seen in association with the Bronzed Drongo and is an excellent mimic.

Breeding: The testes of the specimens were in normal non-breeding condition. *Nidification* (ii, 331) records that Stewart took its nests in Travancore at about 1,000 ft. and 3,000 ft. elevation. The dates are not mentioned.

Chaptia aenea malayensis Blyth. The Southern Bronzed Drongo.

Specimens collected: 3 ♀ 4-1-33 Marāiyūr 3,500 ft.; 232 ♂ 7-2-33, 263 ♂ 10-2-33 Thattākād 200 ft.; 739 ♀ 29-7-33 (Kūttāni 300 ft.), 797 ♀ 6-8-33, 834 ♂ 4-8-33 (Pūlayanār Kotta 200 ft.) Trivandrum Talūk.

Elsewhere noted at: Sānthanpāra (3,500 ft.); Ūrūmbikera Forest, near Mūndakāyam (1,000 ft.); Kottāyam (ca. S.L.); Kūmili and Periyār Lake Environs (3,000 ft.); Camp Derāmalāi (3,000 ft.); Rājampāra (1,350 ft.); Chālakudi; Kūriārkūtti (1,600 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.—Nelliampathies).

Colours of bare parts: Iris reddish-brown to crimson; bill, legs, feet and claws black; mouth greyish-pink or slaty-pink.

[Other specimens examined:

B. M. Coll.: ♂ 17-6-77 Tandigudi 4,000 ft., Lower Pālnis (Fairbank); ♀ -10-78, ♀ 23-9-74 Mynall, Travancore (Bourdillon).

The presence or absence of white spots on the outer wing coverts appear to me to be a question of individual variation rather than of age.—H. W.]

The Bronzed Drongo is an ubiquitous species in well-wooded tracts throughout the area, both in the low country and in the hills up to least 3,500 ft. and perhaps higher.

Mixed bamboo forest rather than dense evergreen jungle, rubber plantations, cardamom sholas and the groves of mango, cashew and jack fruit, etc., by the backwater homesteads are some of its favourite haunts. They are noisy birds having a large repertoire of loud musical calls and are accomplished mimics besides. They are usually seen singly or in widely separated pairs alongside forest roads, firelines, etc. and often as members of the localised bird associations in forest.

In the Pālnis, Fairbank (*S.F.*, v, 401) considered it one of the commonest birds at the base of the hills and up to 5,000 ft. elevation. It does not extend to Ceylon.

Breeding: Nesting was in progress during February. No. 232 (7 February) had the testes enlarged to 8×4 mm.; 263 (10 February) to 7×4 mm.

On 11 February (Thattākād) a nest was observed in the process of construction in a young teak plantation. It was a neat round cup of bast fibres, cemented on the outside with cobwebs, wedged in the horizontal fork of a thin bare branch of a teak sapling at about 14 ft. from the ground. One of the owners—apparently male, as calling—was observed turning round and round within to give it shape. No eggs had as yet been laid. The nest was very inconspicuous amongst its surroundings of bare branches and withering leaves, but there seemed to be no deliberate attempt at concealment. The July specimens were undergoing complete post-nuptial moult.

Chibia hottentotta (L.). The Indian Hair-Crested Drongo.

No specimens obtained, neither does Ferguson appear to have come across this species in Travancore. I observed a pair—the only examples in Travancore or Cochin—at Thattākād and have not the slightest doubt as regards their identity since they were watched for a considerable time through field glasses on three consecutive days. The birds were excessively shy, however, and I could never get within gun-shot of them. They kept to a patch of *Erythrina lithosperma* trees with heavy thorny and tangled undergrowth, and fed largely on the nectar of these blossoms, frequently attacking and diving off other birds feeding on adjoining branches.

As no specimens from Travancore apparently exist, it would be interesting to learn on what grounds Mr. Baker has fixed the type locality of his race *hottentotta* as Travancore (*Fauna*, vii, 164). See also *J.B.N.H.S.*, xxxvi, 352.

Breeding: According to Bourdillon (*Nidification*, ii, 321) this drongo breeds in Travancore from the end of February to June. He himself is said to have taken nests fom 15 March to 26 April.

[**Dissemurulus lophorinus** (Vieillot). The Ceylon Black Drongo.

The *Fauna* (ii, 373-4) implies that this Drongo is a common bird in Travancore, but since neither Bourdillon, Ferguson nor myself ever came across it there or in Cochin it is difficult to accept the implication until skins can be produced in support. Since the whole claim for its occurrence and breeding in Travancore rests on the possibly vicarious authority of Mr. J. Stewart who, as we know, often had his eggs collected for him and brought in by local hillmen, the doubtfulness of the records becomes all the more heightened.

Nidification (ii, 339) says that in Travancore 'it has been found breeding freely in great numbers by J. Stewart'. All his eggs are said to have been taken between 13 March and 30 April.]

Dissemurus paradiseus malabaricus (Latham). The Malabar Large Racket-tailed Drongo.

Specimens collected: 122 ♂ 22-1-33, 135 ♂ 23-1-33 Sānthanpāra 3,500 ft.; 488 ♂ 24-3-33 Tenmalāi 500 ft.

Elsewhere noted at: Marāiyūr (3,500 ft.); Thattākād (200 ft.); Ūrūmbikera Forest near Mūndakāyam (1,000 ft.); Kūmili and Periyār Lake Environs (3,000 ft.); Camp Derāmalāi (3,000-4,000 ft.); Rājampāra (1,350 ft.); Balamore Estate (2,000 ft.—Ashāmbū Hills); Kūriārkūtti and Parambikolam (1,500-2,500 ft.); Wadakkāncheri (400 ft.); Pādagiri (3,000 ft.—Nelliampathy Hills).

Colours of bare parts: Iris brown to reddish-brown; bill, legs, feet and claws black; mouth slaty-pink (in 135 yellowish-flesh colour).

[Additional material seen:

Brit. Mus. Coll.: ♂ -10-70, ♂ 11-1-76 Mynall, Travancore (Bourdillon).

I do not give measurements as there is some variation in them and I am not yet able to interpret the ages of this species satisfactorily, and shall not be able to do so until I can examine more autumn birds of which the sexing and age determination by skull are satisfactory, so that one is certain one is handling young birds.

There appears to be some instability in the variation of the tail in the juvenile, some apparently having a juvenile tail, others having it similar to the adult. Also I think the races may differ *inter se* in these details. When all these points are worked out one must settle the races.—H. W.]

The Racket-tailed Drongo is associated with the well-wooded tracts of the States, chiefly mixed bamboo forest or where there is a mingling of the deciduous and evergreen types. It was met with in suitable low country as at Wadakkāncheri and Thattākād and through the foothills up to an elevation of at least 4,000 ft., almost invariably as a member of the localised hunting parties which usually include the Southern Tree Pie and various Flycatchers and Phylloscopi. It is a noisy bird and has a large variety of loud metallic musical notes of its own besides being a very good mimic of other species.

It is common in the Pālni Hills. In Ceylon, according to G. M. Henry (*Ceylon Jour. of Sci.,* Sec. B, Zool. and Geol., xviii, pt. 22 December 1933, p. 146) it is represented in the dry zone by the smaller race *D. p. ceylonensis* while in the wet zone *Dissemurulus lophorinus* completely replaces it.

Breeding: According to Ferguson (*J.B.N.H.S.,* xv, 455) it breeds in Travancore during April and May. From their behaviour I have no doubt that the birds were breeding in March and a specimen shot on the 24th of that month (No. 488) had its testes enlarged to 18×8.5 mm.

The earliest eggs recorded are on 18 February (Stewart), the latest 10 May (Bourdillon). Three eggs usually comprise a full clutch; rarely four (*Nidification*, ii, 349).

(*To be continued*).

FEEDING OF COBRAS IN CAPTIVITY.

BY

DR. S. G. TSCHERBAKOFF.

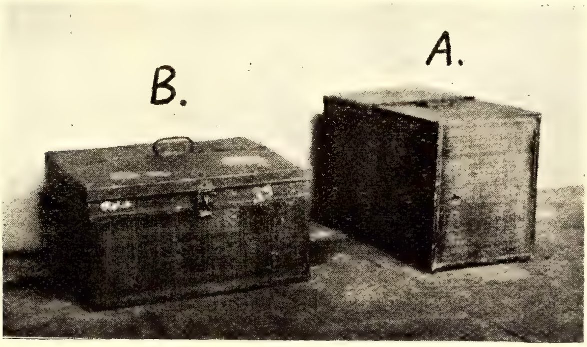
(From the Haffkine Institute, Bombay).

As regards the feeding habits of cobras in captivity, there appears to be some difference of opinion among observers. For example, Wall, in his 'Popular Treatise on the common Indian Snakes', mentions that the cobra feeds principally on rats, frogs, toads, and less frequently on birds, and that it seems to show no special preference for any of these creatures under natural conditions. In captivity, however, many specimens feed eagerly and thrive well. Nicholson, on the other hand, in his book on *Indian Snakes* maintains that he has never seen cobras in captivity feed, and unless fed forcibly they would starve themselves to death. An opportunity offered itself during this year, at the Haffkine Institute, to study the feeding habits of cobras in captivity.

An attempt has been made in this paper to record the facts observed during the course of some experiments, carried out to find the best method of feeding cobras.

COBRAS IN CAPTIVITY AT THE HAFFKINE INSTITUTE.

Cobras are received at the Institute from far off places and are despatched in specially designed wooden boxes. As soon as the snakes arrive, they are removed from these boxes and are kept separately, each in a japanned tin box. The tin boxes in use are of two types. Type A measures 52 × 26 × 30 cm.; one of its sides measures 24 × 28 cm. and is of wire gauze (10 meshes to 2.5 cm.) and nearly half of the top of the box forms a lid which opens and shuts by hinges. Type B measures 45 × 36 × 23 cm.; in this type the two opposite sides of the box are of wire gauze, one measuring



Two types of cages for keeping live Snakes.

43 × 21 cm. and the other 43 × 15 cm. (See photograph of types A and B.)

At the time when these experiments were commenced, nearly one half of the snakes were kept in a well ventilated room on the top floor of the Institute, where plenty of air and light could be had. The rest were kept in the animal house in a small room which had no special arrangements for proper ventilation except that the two doorways of the room faced each other. The experiments were carried out during the monsoon months namely from 10th June to 15th October 1934, when the average lowest minimum temperature was about 74° F. and the total rainfall about 70″. On the 1st of June 1934 there were in all 319 cobras (*Naia tripudians*), and these were obtained from the following places:—

Madras ...	268	Narasingpore ...	4
Mysore ...	19	Raibanore ...	21
Wardha ...	5	Gwalior ...	2

From June to September 1934, 131 cobras died in captivity, the mortality among these being distributed as follows:—

June	1934	58
July	,, ...	29
August	,, ...	22
Sept.	,, ...	22

The records of the Colaba observatory for the corresponding dates are as follows:—

Month	Highest maximum temperature during the month	Lowest minimum temperature during the month	Total rainfall during the month
June 1934 ...	93·5°	74·7°	29·06″
July ,, ...	88·8	72·9	22·74
August ,, ...	86·6	73·9	12·14
Sept. ,, ...	89·0	73·5	5·83
			69·77″

The mortality among the cobras kept in the well ventilated room and in the animal house was as follows:—

Where housed	No. of Cobras on 1st July 1934	Died			Total died	Percentage Mortality
		July	Aug.	Sept.		
Upstairs ...	113	9	12	8	29	25·7
Animal House.	148	20	10	14	44	30·0

EXPERIMENTS ON THE FEEDING OF COBRAS.

The methods employed for the feeding of cobras in these experiments were so devised as to obtain comparative results.

Experiment I. One hundred cobras were fed with live rats. The rats selected for this purpose were the Bombay *Rattus rattus*, which are sent to the Institute daily by the Municipality of Bombay for the detection of plague. These rats were kept under observation for several days to ensure that they were free from any natural infection. The rats selected weighed from 30 to 70 grams; and according to the size of the cobra the weight of the rat used varied. A live rat was dropped into the cage of each cobra. After 24 hours it was noticed that only 27 cobras had swallowed the rats. Fifty-five rats were killed but not eaten, and these were removed from the cages as they began to decompose. Eighteeen rats were found alive although they had been with the cobras for 24 hours; and some of these were removed from the cages. It was also noticed that the rats which were left alive in the cages for longer periods continued to live for a period of five days; during this period, driven by hunger, they started to nibble at the cobras, and therefore they had to be removed.

During the course of this experiment it was noticed that when a cobra struck at a live rat, the rat died within one and a half to three minutes. In no case did the survival period exceed four minutes. When the cobra saw its prey dead, it commenced to swallow it by working its teeth and lower jaw until the prey was gradually forced in, and in about three minutes the entire rat disappeared from view. During the process of swallowing the epiglottis was often projected forwards to take in air and thus prevent suffocation. Also during the process of swallowing the whole body of the cobra remained stationary; but immediately the prey disappeared down its throat, the cobra began to make a somewhat circular movement and within a very short time (about three minutes) the prey reached its destination, namely the region of the stomach. This circular movement was repeated over and over again at intervals of a few minutes. After about half an hour the cobra retired to a corner of the cage and remained coiled up. It was observed that before retiring to the corner the cobra made peculiar movements suggesting that it was searching for something. It was thought that this might be a drink of water. So a plate full of water was introduced into the cage. The cobra drank very freely and since then the practice of giving water to the cobras after each feed has been continued. In these experiments it was noticed that it took on the average five days for a cobra to digest a live rat.

Experiment II. One hundred cobras were fed on dead rats. These rats were killed by drowning in a pail of water and were immediately placed in the cages. Only 28 cobras swallowed the rats.

Experiment III. One hundred cobras were given about 30 grams each of minced beef bought fresh. In only 18 cases did this method of feeding prove successful.

Experiment IV. Next a whole hen's egg was placed in each of 25 cages. The snakes did not seem to take notice of the eggs and all the eggs remained entire even after five days.

Experiment V. One hundred cobras were fed as follows:—Rats were killed by drowning and were cut in two longitudinally and all the internal organs removed. From 30 to 50 grams of this cut-up meat were placed in each of the hundred cages. Thirty-seven cobras fed successfully by this method.

It was also noticed that when a cobra failed to swallow the cut-up meat within three hours of its being offered, it very rarely ate; and only in a very few cases was this meat eaten up to within six hours. In all these experiments the food left uneaten was removed after 24 hours of its introduction into the cages. It was observed that a cobra took three days to digest a cut-up rat.

During the experiments it was observed that all the cobras did not behave alike with regard to their feeding. According to their feeding behaviour they can be divided into three groups.

Group 1. Those that refused to feed at all. The behaviour of cobras Nos. 313 and 329 in the following table are cited as examples to illustrate this.

Cobra 313			
30-6-34	...	L	—
3-7-34	...	L	—
19-7-34	...	D	—
31-7-34	...	M	—
1-8-34	...	C	—
10-8-34	...	C	—
20-8-34	...	C	—
30-8-34	...	C	—
10-9-34	...	C	—

Cobra 329			
27-6-34	...	L	—
30-6-34	...	L	—
2-7-34	...	C	—
20-7-34	...	C	—
31-7-34	...	M	—
1-8-34	...	C	—
10-8-34	...	C	—
20-8-34	...	C	—
30-8-34	...	C	—
10-9-34	...	C	—
14-9-34	...	L	—

Note : (—) Means refused to eat.
L means Live rat ;
D ,, Dead rat ;
M ,, Meat ;
C ,, Cut-up rat.

Group 2. Those that fed upon rats in any form—whether alive, dead or dissected, and on meat (beef). The behaviour of cobras Nos. 321 and 372 in the following table are cited as examples to illustrate this.

Cobra 321		
2-7-34	L	*
19-7-34	D	*
31-7-34	M	*
10-8-34	C	*
20-8-34	C	*
30-8-34	C	*
10-9-34	C	*

Cobra 372		
27-6-34	L	*
6-7-34	D	*
20-7-34	C	*
1-8-34	C	*
7-8-34	M	*
22-8-34	C	*
3-9-34	C	*
14-9-34	C	*
15-9-34	L	*
18-9-34	L	*
19-9-34	L	*
20-9-34	L	*
21-9-34	L	*

Note : * means positive feeding or fed successfully.

Group 3. Those that preferred only one type of food either a live rat or a dissected one. (a) The behaviour of cobras Nos. 29 and 115 in the following table illustrates the results obtained with dissected rats.

Cobra	29	
23-6-34	L	—
26-6 34	L	—
9-7-34	D	—
25-7-34	C	*
3-8-34	C	*
13-8-34	C	*
25-8-34	C	*
4-9-34	C	*
19-9-34	C	*

Cobra	115	
19-6-34	C	*
2-7-34	L	—
9-7-34	D	—
14-7-34	L	—
25-7-34	C	*
7-8-34	C	—
17-8-34	L	—
27-8-34	C	*
10-9-34	C	*
21-9-34	C	*

(b) The behaviour of cobras Nos. 18 and 220 in the following table illustrates the results obtained with live rats.

Cobra	18	
26-6-34	L	*
9-7-34	D	—
25-7-34	C	—
3-8-34	C	—
13-8-34	L	*
25-8-34	C	—
4-9-34	L	*
11-9-34	L	*

Cobra	220	
23-6-34	L	*
16-7-34	D	—
27-7-34	C	—
7-8-34	M	—
13-8-34	L	*
17-8-34	C	—
30-8-34	C	—
4-9-34	L	*

The following table shows the combined results obtained by the various methods employed for the feeding of cobras from 16-6-1934 to 25-7-1934.

Methods of feeding cobras with	No. of observations made	Percentage of successful feedings
Live rats	200	25
Dead rats (drowned) ...	200	24
Dissected rats ...	195	37
Beef meat	200	15

Since then *over one thousand observations* have been made with dissected rats, and the results have shown the average percentage of successful feedings by this method to be 33.

The snakes that refused to feed had to be forcibly fed. The method employed at the Institute prior to these experiments, consisted in pouring down the gullet of the cobra a mixture of egg and milk. On an average each cobra received about 30 cc. of egg content and 40 cc. of milk. When this was given it was observed that about 33 per cent of cobras thus fed vomited almost the entire quantity within 5 to 15 minutes of their feeding. Therefore a change was made in the mixture by increasing the amount of egg content to 45 cc. and decreasing the quantity of milk to 20 cc. By employing this method it was observed that only about 10 per cent of the cobras vomited after feeding.

MORTALITY AMONG COBRAS AND ITS RELATIONSHIP TO FEEDING.

As most of the deaths among the cobras were due to starvation, the results of these feeding experiments with special reference to mortality among cobras have been arranged under four groups.

Group 1. In this group are included all those cobras that fed successfully each time they were supplied with food. During the course of this experiment nine attempts were made at feeding each cobra with dissected rats. Among the 33 cobras thus fed, there was not a single death until the 15th October 1934 (the period of starvation).

Group 2. In this group of 68 cases, most of the feedings were successful. During the period of observation 10 died giving a percentage mortality of 14·7.

If groups 1 and 2 are combined they give a percentage mortality of only 10.

Group 3. In this group are included those cases where the cobras fed only once and then refused to feed when six or seven attempts at feeding them were made. Out of 17 cobras 9 died with a percentage mortality of 53.

Group 4. All the 160 cobras in this group did not feed at all of their own accord and therefore had to be forcibly fed with egg and milk. The number of deaths in this group was 80 giving a percentage mortality of 50.

If groups 3 and 4 are combined they give a percentage mortality of 50·3.

The above results seemed to indicate that the method of feeding cobras in captivity with dissected rats was not only attended with a larger percentage of successful feedings, but was quite safe since there was not a single death (during the period of five months' observation) among the cobras thus fed, thus showing that there was not appreciable injury caused by the swallowing of exposed bones in the dissected rats.

THE FREQUENCY WITH WHICH COBRAS COULD FEED.

During the course of these experiments an attempt was made to study how much and how often a cobra would feed. Wall relates instances regarding the voracious nature of some snakes in captivity. This was found to be the case with some cobras as the following table well illustrates.

Case No.	17–9–1934	18–9–1934	19–9–1934	20–9–1914	21–9–1934	22–9–1934	23–9–1934	24–9–1934	25–9–1934	26–9–1934	27–9–1934	28–9–1934	29–9–1934	30–9–1934	1–10–1934	2–10–1934	3–10–1934	4–10–1934	5–10–1934	6–10–1934	7–10–1934	8–10–1934
390	*	*	*	–	–	.	.	–	*	*	*	*	.	.	.	*	*	*	*	.	.	*
391	*	*	*	–	–	.	.	–	*	*	*	*	.	.	.	*	*	*	*	.	.	*
392	*	–	–	*	–	.	.	*	*	*	*	*	.	.	.	–	–	–	–	.	.	–
397	*	–	–	*	–	.	.	–	*	–	–	–	.	.	.	*	–	–	–	.	.	*

Note.—* means positive feeding ;
– ,, negative feeding or not fed ;
. ,, feeding not carried out.

From 25-9-1934 to 8-10-1934, cobras 390 and 391 fed almost on all successive days, the break in daily feeding being unavoidable on account of holidays.

Relation between Feeding and the Yield of Venom.

Dowsett mentions that snakes in captivity lose the greater part of their venom. Experiments carried out here did not support this view.

The method employed at the Institute was that as soon as the cobras were received, their venom was extracted and then they were forcibly fed with a ration of milk and eggs. Afterwards they were fed periodically and venom was extracted at intervals of two weeks.

Experiment VI. Between July 12th and July 25th, 1934, on first extraction an yield of 34·680 grams of dry venom was obtained from 233 cobras, giving an average of 0·149 grams per cobra. The venom was dried over calcium chloride in vacuo.

At the second extraction between July 26th and August 11, 1934, of the above group, out of which 6 had died during the interval, 36·270 grams of dry venom was obtained from 227 cobras, giving an average of 0·160 grams per cobra.

At the third extraction between August 14 and September 20, 1934, the above group, out of which 22 had died, gave 40·445 grams dry venom, showing an average yield of 0·198 grams per cobra.

From 8th to 27th September, 1934, experiments were carried out with two groups A and B, each of which consisted of 50 cobras.

Group A, consisting of cobras which regularly and successively fed on rats, yielded 12·020 grams dry venom, whereas

Group B, comprising cobras which refused to feed and had to be forcibly fed, yielded 8·275 grams dry venom.

This showed that cobras when properly fed, especially with rats, yield an increased quantity of venom.

In another group of 36 snakes which were received at the Institute as follows:—

November 1933	11
December	7
January 1934	4
March	10
April	1
May	2
June	1

the total venom yield on *first extraction* was 6·247 grams. These snakes were feeding regularly and the extraction of the venom took place at regular intervals of 2 to 3 weeks. The total venom on final extraction in September 1934 was 8·105 grams. All cobras in this group were fed successfully with rats.

Yet in another group, 31 cobras were forcibly fed on milk and egg. They were received at the Institute as under:

November 1933	9
December	10
March 1934	10
April	2

On first extraction they gave 7·305 grams dry venom and finally in September 1934 they yielded only 6·485 grams.

All the above experiments seemed to indicate that proper feeding increased the quantity of venom or at least kept up to the initial yield.

In the course of these experiments the maximum yield of fresh venom which was obtained from one cobra was 1·750 grams and from another the minimum yield was 0·040 grams.

The maximum yield of dry venom was 0·530 grams and the minimum 0·010 grams.

Some interesting observations were made during these experiments. These are (1) cobras thrive when housed in a dry and well ventilated room; (2) they drink water freely after a feed; and (3) black cobras are the easiest to feed.

SUMMARY.

1. Feeding cobras in captivity with dissected rats gave the largest percentage of positive or successful feeding. This method was found to be quite safe.

2. In some cases it seemed necessary to feed cobras with dissected rats as well as with live rats.

3. At times cobras exhibited individual idiosyncrasies and it was necessary therefore to feed them on that type of food which they preferred.

4. With cobras which fed well in captivity the yield of venom during one year compared favourably with that obtained when the cobra arrived first at the laboratory.

5. Even from starving cobras a certain amount of venom could be collected till their death.

6. A cobra took about three days to digest a dissected rat and about five days to digest a live rat.

7. As regards the time when cobras should be fed it appeared that, when extraction of venom was attempted, they were best fed with dissected rats once in ten days and venom extracted after seven days from the time of the feeding, as immediately after a feed the yield of venom became considerably less. At least an interval of three days seemed necessary between the extraction of venom and the next feed.

I take this opportunity to express my deep indebtedness to Lieut.-Col. S. S. Sokhey, I.M.S., the Director of the Haffkine Institute for the facilities placed at my disposal for carrying out this piece of study. My thanks are also due to Dr. B. P. B. Naidu, Dr. P. M. Wagle and Rao Bahadur Dr. G. D. Chitre for assistance rendered in several ways during the course of these experiments, and to Dr. S. C. Roy, Meteorologist, Bombay, for the information about temperature and rainfall.

THE BUTTERFLIES OF THE NILGIRI DISTRICT.

BY

J. A. YATES.

In his enumeration of local lists of butterflies, Evans (*Identification of Indian Butterflies*, 2nd edition) mentions Sir George Hampson's list published in the *Journal of the Royal Asiatic Society*, 1888. I venture in the subjoined list to revise his list, both by giving the names as in Evans and by adding butterflies taken subsequently. Brigadier Evans has been good enough to let me see his copy of Hampson's list, with additions made by Stokes Roberts in manuscript. I have also been able to consult Col. Winckworth's list, verified by specimens in his collection. Hampson's excellent description of the area requires no modification. Lastly both Brigadier Evans and Mr. Gabriel of the Entomological Department, British Museum, kindly helped me to verify the fact that certain species have been found in the Nilgiris. These I have specially noted in the following list.

The Nilgiris are popular with collectors, both schoolboy and adult. I thought therefore it might be of service to both classes of collectors to give them a revised list.

I should add that Brigadier Evans thinks that one or two changes will have to be made in nomenclature. He has kindly permitted me to include some of his latest conclusions: notably under *Padraona*, where *Padraona pseudomaesa pseudomaesa* M. replaces *Padraona cato cato* Evans, and *Padraona pallida pallida* Evans replaces *Padraona pseudomaesa pseudomaesa* M. The *Baoris* group will eventually be split up, I understand; but meanwhile one may note that the form described as *B. mathias* var. *agna* M. (D. S. F.) is now definitely considered as a species.

I have rearranged Hampson's list to make it tally with Evans'. The numbers in brackets are Hampson's original numbers. Where no number occurs the inclusion of a species is due to Stokes Roberts or to Winckworth, or to its being in the British Museum collection.

A. PAPILIONIDAE.

A1.
(193) 1*b*. **Troides helena minos** Or.

A2.
(197) 8*b*. **Tros jophon pandiyana** M.
(198) 9. **Tros hector** L.
(199) 10*b*. **Tros aristolochiae aristolochiae** F.

A3.
(195) 5*b*. **Chilasa clytia clytia** L.
(194) 5*b*. **Chilasa clytia *var.* dissimilis** L.

A4.
(206) 1*b*. **Papilio polymnestor polymnestor** Cr.
(205) 10*a*. **Papilio paris tamilana** M.

(203) 13. **Papilio crino** F.
(294) 14. **Papilio buddha** Wd.
(196) 16. **Papilio dravidarum** Wm.
(202) 19*b*. **Papilio helenus daksha** M.
(201) 25*a*. **Papilio polytes romulus** G.
'The three forms of the female occur.' (Hampson)
(212) 26*a*. **Papilio demolion liomedon** M.
(200) 27*a*. **Papilio demoleus demoleus** L.

A5.
(207) 4*a*. **Pathysa nomius nomius** Esp.

A6.
(208) 2*a*. **Zetides sarpedon teredon** Fd.
(210) 3*b*. **Zetides doson eleius** Fr.
(211) 8*a*. **Zetides agamemnon menides** Fruh.

(*Note.*—I can find no record of *Pathysa antiphates naira* M. as from the Nilgiris.)

B. Pieridae.

B1.
(157) *a*. **Leptosia nina nina** F.

B4.
(184) 10*a*. **Pieris canidia canis** Evans.

B6.
(192) 3. **Delias eucharis** Drury.

B7.
2. **Prioneris sita** Fd. (B. M., Crowley).

B8.
(188) *b*. **Belenois mesentina mesentina** Cr.

B9.
(185, 186) 2*a*. **Huphina nerissa evagete** Cr.
(187) 3*b*. **Huphina nadina remba** M.

B10.
(176) 3*b*. **Appias indra shiva** Swin.
(183) 4*a*. **Appias libythea libythea** F.
(182) 5*b*. **Appias lyncida latifasciata** M.
6*b*. **Appias albina darada** Fd. (Winckworth) ♀ *var.* **semiflava** (Winckworth).
(177-181) 7*b*. **Appias paulina wardi** M.

B11.
(162) 1. **Catopsilia crocale** Cr.
(161) 2. **Catopsilia pomona** F.
♀ *var.* **catilla** Cr.
(164) 4. **Catopsilia pyranthe minna** Herbst.
(163) 5. **Catopsilia florella gnoma** F.

B15.
(159) 1. **Terias drona**. Hors. (*T. libythea* F., in Evans' list).
(160) 2*a*. **Terias laeta laeta** Bdv.
(158) 4*a*. **Terias blanda silhetana** Wall.
(158) 5*a*. **Terias hecabe simulata** M.
5*a*. **Terias andersoni ormistoni** Watkins (B. M., Moore, Watson, Broughton).

B16.
(175) 5*a*. **Colias hyale nilagiriensis** Fd.

B17.
(167, 168) 1. **Ixias marianne** Cr.
(165, 166) 2*b*. **Ixias pyrene frequens** But.

B18.
(173) 1*a*. **Colotis amata modesta** But.
(174) 4*a*. **Colotis fausta fulvia** Wall.
(171) 5*b*. **Colotis etrida etrida** Bdv.
(170) 6. **Colotis aurora** Cr. (=*C. eucharis*, F., in Evans' list).
(172) 7*a*. **Colotis danae danae** F.

B19.
(169) *b*. **Hebomoia glaucippe australis** But.

B20.
(189, 190) 2*a*. **Pareronia ceylanica ceylanica** Fd.
(191) 3. **Pareronia valeria hippia** F.

C. DANAIDAE.

C1.
(1) 1*b*. **Hestia lynceus malabarica** M.

C2.
(6) 1*a*. **Danais aglea aglea** Cr.
(7) 7. **Danais nilgiriensis** M.
(2) 9. **Danais limniace mutina** Fruh.
(3) 10*b*. **Danais melissa dravidarum** Fruh.
(5) 12. **Danais plexippus** L.
(4) 15. **Danais chrysippus** L. *var.* **alcippoides** M.

C3.
(9) 7*b*. **Euploea core core** Cr.
(10) 12*b*. **Euploea coreta coreta** God.
(8) 18*b*. **Euploea crassa kollari** Fd.

D. SATYRIDAE.

D2.
(11) 3*a*. **Mycalesis anaxias anaxias** Hew.
(18) 9*a*. **Mycalesis perseus typhius** Fruh.
(14) 10*a*. **Mycalesis mineus polydecta** Cr.
11. **Mycalesis igilia** Fruh. (Winckworth).
(14) 12*a*. **Mycalesis visala visala** M.
15. **Mycalesis khasia orcha** Evans.
(15) 20. **Mycalesis adolphei** Guer.
14. **Mycalesis subdita** M. (Winckworth).
(16) 32*b*. **Mycalesis patnia junonia** But.

D3.
(17) 21*a*. **Lethe europa ragalva** Fruh.
(19) 22*a*. **Lethe rohria nilgiriensis** Guer.
(18) 23*b*. **Lethe drypetis todara** M.

D14.
(22) 6. **Ypthima asterope mahratta** M.
(25) 9. **Ypthima chenui** Guer.
(23) 11*a*. **Ypthima hubneri hubneri** Kirby.
(24) 10. **Ypthima ceylonica** Hew.
(21) 13*b*. **Ypthima avanta striata** Hamp.
14*a*. **Ypthima baldus madrasa** Evans.
(26) 14*a*. **Ypthima philomela tabella** Mar. and DeN.

D15.
(27) 1. **Zipoetis satis** Hew.

D16.
(12) *a*. **Orsotrioena medus mandata** M.

D22.
(30) 1. **Melanitis leda ismene** Cr.
(28, 29) 2*b*. **Melanitis phedima varaha** M.
(31) 3*a*. **Melanitis zitenius gokala** M.

D25.
(32) 1*b*. **Elymnias hypermnestra caudata** But.

E. Amathusiidae.

E10.
(33) 3*b*. **Discophora lepida lepida** M.

P. Nymphalidae.

F1.
(83) 2*b*. **Charaxes polyxena imna** But.
(82) 7*b*. **Charaxes fabius fabius** F.

F2.
(18) 2*a*. **Eriboea athamas agrarius** Swin.
F7.
(44) 8*b*. **Apatura parisatis atacinus** Fruh.

F10.
(39) 1*a*. **Euripus consimilis meridionalis** WM.

F18.
(73) 3*a*. **Euthalia lepidea miyana** Fruh.
(74) 14*b*. **Euthalia garuda meridionalis** Fruh.
(75) 17*b*. **Euthalia lubentina arasada** Fruh.
(72) 27*b*. **Euthalia evelina laudabilis** Swin.
(71) 28. **Euthalia nais** Forst.

F20.
(65) *b*. **Parthenos sylvia virens** M.

F24.
(66) 7*b*. **Limenitis procris undifragus** Fruh.

F25.
(70) 2*a*. **Pantoporia nefte inara** Db.
(69) 4*a*. **Pantoporia selenophora kanara** Evans.
(68) 10*a*. **Pantoporia ranga karwara** Fruh.
(67) 14. **Pantoporia perius** L.

F26.
(57) 1*a*. **Neptis columella nilgirica** M.
(58) 2*b*. **Neptis jumbah jumbah** M.
(53, 54) 6*a*. **Neptis hylas varmona** M.
(55) 7*a*. **Neptis soma kallaura** M.
(56) 8*a*. **Neptis nandina hampsoni** M.
(52) 26*a*. **Neptis viraja kanara** Evans.
(51) 32*b*. **Neptis hordonia hordonia** Stoll.

F27.
(79) 4*a*. **Cyrestis thyodamas indica** Evans.

F30.
(63) 1. **Hypolimnas misippus** L.
♀ *var.* **alcippoides** But.
♀ *var.* **inaria** Cr.
(62) 2. **Hypolimnas bolina** L.

F33.
b. **Doleschallia bisaltide malabarica** Fruh. (Stokes Roberts).

F34.
(80) 1*b*. **Kallima philarchus horsfieldii** Koll.

F35.
(49) 1*a*. **Precis hierta hierta** F.
(50) 2*a*. **Precis orithyia swinhœi** But.
(48) 3*a*. **Precis lemonias vaisya** Fruh.
(46) 4*a*. **Precis almana almana** L.

(47) 5. **Precis atlites** L.
(45) *6a.* **Precis iphita pluviatalis** Fruh.

F36.
(76) 1. **Vanessa cardui** L.
(77) *3a.* **Vanessa indica pholae** Fruh.
(78) *4b.* **Vanessa canace viridis** Evans.

F39.
(64) *1g.* **Argynnis hyperbius hybrida** Evans.

F41.
(40) *b.* **Cupha erymanthis maja** Fruh.

F42.
(41) 1. **Atella phalanta** Drury,

F44.
(43) *b.* **Cynthia erota saloma** Swin.

F45.
(59, 60, 61) *4b.* **Cirrochroa thais thais** F.

F47.
(42) *2b.* **Cethosia nietneri mahratta** M.

F.48.
(38) **Byblia ilithyia** Drury.

F49.
(37) *1b.* **Ergolis ariadne indica** M.
(35, 36) *2b.* **Ergolis merione merione** Cr.

F52.
(34) **Telchinia violae** Fab.

H. Erycinidae.

G1.
(85) *2a.* **Libythea lepita lepitoides** M.
(84) *3b.* **Libythea myrrha carma** Fruh.

G4.
(86) *5b.* **Abisara echerius suffusa** M.

H. Lycaenidae.

H8.
(87) *a.* **Spalgis epius** Wd.

H10.
(123) *a.* **Talicada nyseus nyseus** Guer.

H11.
(106) *1a.* **Castalius rosimon rosimon** F.
(105) *2b.* **Castalius caleta decidia** Hew.
(107) *3a.* **Castalius ethion ethion** Db. and Hew.

H12.
(108) 1. **Tarucus ananda** DeN.
(104) 9. **Tarucus nara** Koll.

H13.
(103) **Syntarucus plinius** F.

H14.
(101) 1. **Azanus ubaldus** Cr.
(102) 4. **Azanus jesous gamra** Led.

H17.
(88) **Neopithecops zalmora** But.

H18.
(109) *5a.* **Everes parrhasius parrhasius** F.

H20.
(89) *a*. **Megisba malaya thwaitesi** M.

H21.
(91) 2*b*. **Lycaenopsis puspa gisca** Fruh.
(91) 2. **Lycaenopsis lilacea** Hamp.
(92) 10. **Lycaenopsis albidisca** M.
(94) 14. **Lycaenopsis akasa mavisa** Fruh.
(93) 19*b*. **Lycaenopsis lavendularis limbata** M.

H23.
(95, 96) *a*. **Chilades laius laius** Cr.

H24.
(97) 1*a*. **Zizeeria trochilus putli** Koll.
(100) 3*a*. **Zizeeria maha ossa** Swin.
4. **Zizeeria lysimon** Hub. (Stokes Roberts).
(98) 5. **Zizeeria gaika** Trimen.
(99) 6*a*. **Zizeeria otis discreta** But.

H25.
(119) 1. **Euchrysops cnejus** F.
2*b*. **Euchrysops contracta contracta** But. (B.M.).
3*a*. **Euchrysops pandava pandava** Hors. (Stokes Roberts).

H26.
(111) 2*a*. **Lycaenesthes lycaenina lycaenina** Wd.

H27.
(118) 1. **Catachrysops strabo** F.

H28.
(120) **Lampides boeticus** L.

H29.
(110) 1*a*. **Jamides bochus bochus** Cr.
(121) 5*b*. **Jamides celeno celeno** Cr.
(122) 9*b*. **Jamides alecto eurysaces** Fruh.

H32.
(118) 3*a*. **Nacaduba hermus nabo** Fruh.
(114) 7*a*. **Nacaduba helicon viola** M.
(112) 8*b*. **Nacaduba kurava euplea** Fruh.
9*b*. **Nacaduba beroe gythion** Fruh. (B. M., Watson and Moore).
(115) 15*a*. **Nacaduba nora nora** Fd.
(115) 16*a*. **Nacaduba dubiosa indica** Evans.
(117) 17*b*. **Nacaduba noreia hampsoni** DeN.
(117) 19. **Nacaduba dana** DeN.

H44.
(90) 1. **Curetis thetis** Drury.
6. **Curetis acuta dentata** M. (Stokes Roberts).

H45.
(129) 1*b*. **Iraota timoleon arsaces** Fruh.

H46.
(155) 1*b*. **Horsfieldia anita dina** Fruh.

H47.
a. **Thaduka multicaudata kanara** Evans (Stokes Roberts).

H49.
(156) 33. **Amblypodia canaraica** M.
39*a*. **Amblypodia amantes amantes** Hew. (Stokes Roberts).

H50.
(154) 1*b*. **Surendra quercetorum biplagiata** But. (=*S. todara* of Hampson).
(138) 4*a*. **Surendra todara todara** M. (=*Rapala distorta* of Hampson).

H53.
(151, 152) *b*. **Loxura atymnus atymnus** Cr.

H57.
(139) 1*b*. **Spindasis vulcanus vulcanus** F.
2. **Spindasis schistacea** M. (Winckworth).
(144) 4. **Spindasis abnormis** M.
6*b*. **Spindasis ictis ictis** Hew. (B. M., Moore, etc.).
(141) 7*b*. **Spindasis elima elima** M.
(142) 13*a*. **Spindasis lohita lazularia** M.

H58.
(132) **Zesius chrysomallus** Hub.

H59.
4*a*. **Pratapa blanka sudica** Evans. (Stokes Roberts).
(145) 8. **Pratapa cleobis** God.

H60.
(147) 8. **Tajuria melastigma** De.N
18. **Tajuria jehana** M. (Winckworth).
(146) 19. **Tajuria cippus cippus** F.
23. **Tajuria maculata** Hew. (Stokes Roberts, in DeNiceville collection).

H61.
(127) 1*a*. **Charana jalindra macarita** Fr.

H70.
(148) *b*. **Cheritra freja jaffra** But.

H76.
(128) **Rathinda amor** F.

H77.
(125) 1*a*. **Horaga onyx cingalensis** M.
(126) 4. **Horaga viola** M.

H78.
(124) 1*a*. **Catapoecilma elegans myosotina** Fruh.

H80.
(149) 1. **Hypolycaena nilgirica** M.

H81.
(150) **Zeltus etolus** F.

H83.
(130) 1*a*. **Deudoryx epijarbas epijarbas** M.

H84.
(134) 1. **Virachola isocrates** F.
(135) 2*a*. **Virachola perse ghela** Fruh.

H85.
(131) 6. **Rapala lankana** M.
(136) 11*a*. **Rapala varuna lazulina** M.
(137) 12. **Rapala schistacea** M.
(133) 16. **Rapala melampus** Cr.

H87.
(153) *a*. **Bindahara phocides moorei** Fruh.

I. HESPERIIDAE.

I1.
7*b*. **Hasora badra badra** M. (B. M., Moore).
(217) 15*a*. **Hasora taminatus taminatus** Hub.
(218) 16. **Hasora alexis alexis** F.

I2.
(216) 8*a*. **Ismene ajina fergusoni** DeN.
(215) 17*a*. **Ismene gomata kanara** Evans.

I3.
(219) *a*. **Bibasis sena sena** M.

I4.
(214) 4*a*. **Choaspes benjaminii benjaminii** Guer.

I5.
(213) **Badamia exclamationis** Fab.

I11.
(263) 3. **Celaenorrhinus ambareesa** M.
(260) 16*b*. **Celaenorrhinus leucocera leucocera** Koll.
(261) 20*a*. **Celaenorrhinus ruficornis area** Pl.

I14.
(259) 3*a*. **Tagiades obscurus athos** Pl.
(258) 10*b*. **Tagiades litigiosa litigiosa** Mosch.

I19.
6*a*. **Daimio bhagava bhagava** M. (Winckworth).

I20.
(268) 1*a*. **Coladenia dan dan** F.
(269) 2*b*. **Coladenia indrani indra** Evans.

I21.
(274, 275) 3*b*. **Sarangesa dasahara davidsoni** Swin.

I23.
(272) *b*. **Tapena thwaitesi hampsoni** El. and Ed.

I25.
(273) 1. **Odontoptilum angulata sura** Fd.

I26.
(270) 1*a*. **Caprona ransonnettii ransonnetti** Ed.
1*b*. **Caprona ransonnettii lanka** Evans.
1*g*. **Caprona ransonnettii taylorii** DeN.

I27.
(255) *a*. **Gomalia elma albofasciata** M.

I28.
(256) 2. **Syrichtus galba** F.

I41.
(220) 1*b*. **Baracus vittatus subditus** M.
(221) 2. **Baracus hampsoni** El. and Ed.

I42.
(243) 1. **Ampittia dioscorides** F.

I43.
(246) 9. **Aeromachus pygmaeus** F.

I45.
(252, 253, 254) 1. **Arnetta vindhiana** M.

I46.
(222) 2*a*. **Iambrix salsala luteipalpus** Plotz.

I47.
(231) 1*b*. **Suastus gremius gremius** F.
(232) 3*a*. **Suastus rama bipunctus** Swin.

I51.
(223) *a*. **Sancus pulligo subfasciatus** M.

I57.
(267) 1. **Udaspes folus** Cr.

I58.
(264) 4*a*. **Notocrypta paralysos alysia** Evans.
(265) 6. **Notocrypta curvifascia** Fd.

I59.
(225) 1*b*. **Gangara thyrsis thyrsis** F.

I64.
(224) 1. **Matapa aria** M.

I66.
(257) 1*a*. **Hyarotis adrastus adrastus** Cr.
(266) 2. **Hyarotis basiflava** DeN.

I83.
2. **Halpe hyrtacus** DeN. (B. M.).
(251) 15. **Halpe astigmata** Swin.
(249) 18*a*. **Halpe sitala sitala** DeN.
(250) 20. **Halpe honorei** DeN.
(247) 31*a*. **Halpe moorei moorei** Watson.
(248) 33*a*. **Halpe egena ceylonica** M.

I87.
(242) *a*. **Cupitha purreea purreea** M.

I88.
(245) 2*b*. **Taractrocera maevius sagara** M.
(244) 3*a*. **Taractrocera ceramas ceramas** Hew.

I89.
1. **Oriens concinna** El. and Ed. (B. M., Hampson).
(241) 3*a*. **Oriens goloides** M.

I90.
(239) 9*a*. **Padraona pseudomaesa pseudomaesa** M. (*syn.* cato.).
10*a*. **Padraona pallida pallida** Evans.
(240) **Padraona tropica diana** Evans.
15*a*. **Padraona palnia palnia** Evans.
(All these, from the Nilgiris, are in the British Museum.)

I91.
1*a*. **Telicota augias augias** L. (Stokes Roberts) (=*Astycus*, Hubner, found to be preoccupiel).
(237) 2*a*. **Telicota lanka** Evans.

I97.
1*b*. **Baoris oceia farri** M. (Winckworth).
(226) 14*b*. **Baoris kumara kumara** M.
15*b*. **Baoris philippina belli** Nov. (Winckworth).
(227) 20. **Baoris contigua** Mab.
(228) 24*a*. **Baoris conjuncta narooa** M.
(236) 30*a*. **Baoris sinensis subochracea** M.
(234) 31*b*. **Baoris mathias mathias** F.
(235) 31*b*. **Baoris agna** M.
(230) 32*b*. **Baoris guttatus bada** M.
33*b*. **Baoris zelleri cinnara** Wallace (Stokes Roberts).
(229) 34*b*. **Baoris bevani bevani** M.

The totals for the Nilgiri District are:—

Papilionidae	18
Pieridae	32
Danaidae	10
Satyridae	25
Amathusiidae	1
Nymphalidae	47
Erycinidae	3
Lycaenidae	80
Hesperiidae	66
	282

I have had the curiosity to compare the lists for the Nilgiri District and Coorg and to tabulate the butterflies found in the one area, but not in the other. They are as follows:—

Nilgiri District.

**Colias hyale nilagiriensis.*
**Pieris canidia canis.*
Mycalesis visala visala.
Ypthima avanta striata.
Ypthima philomela tabella.
**Argynnis hyperbius hybrida.*
Azanus jesous gamra.
Lycaenopsis albidisca.
Lycaenopsis lavendularis limbata.
Iraota timoleon arsaces.
Spindasis elima elima.
Tajuria melastigma.
Tajuria maculata.
Hypolycaena nilgirica.
Gomalia elma albofasciata.
Baracus vittatus subditus.

Total 16

Coorg.

Pathysa antiphates naira.
Parantirrhoea marshalli.
Eriboea schreiberi wardi.
Euthalia telchinia.
Atella alcippe mercea.
Gerydus biggsii.
Lycaenesthes emolus emolus.
Nacaduba pactolus continentalis.
Amblypodia centaurus pirama.
Amblypodia bazaloides.
Amblypodia abseus indicus.
Apharitis lilacinus.
Pratapa deva deva (one ♀).
Chliaria othona.
Astictopterus jama mercara.
Kineta microstictum.
Plastingia submaculata kanara.
Baoris canaraica.

Total 18

In the two lists there are only three species from the Nilgiris, viz.: those asterisked, all palaearctics, that are never likely to occur in Coorg, for the very good reason that Coorg is not sufficiently high. There are others in the Nilgiri list that are not very likely to occur in Coorg, again chiefly for the reason of insufficient altitude, though it is not impossible that they should be found on the higher hills of the western rim of Coorg: these are *Y. philomela tabella*, *L. albidisca*, *N. lavendularis limbata*, and *Baracus vittatus subditus*. *Y. chenui* and *Mycalesis adolphei*, both common in the Nilgiri District, are rare on the higher points of the Coorg Ghats. The rest in the Nilgiri list should be discoverable in Coorg: some, e.g. *Azanus jesous*, *Iraota timoleon*, *Spindasis elima*, and *Gomalia elma* are all found on the Mysore plateau, which extends its forest into eastern and southern Coorg. The two *Tajuria* and *Hypolycaena nilgirica* will, if found, I think be found in the wet forest of the Ghats.

Of the list of species found in Coorg, but not so far in the Nilgiri District, there is none that may not turn up in the Nilgiris, if the artificial boundaries of the District are overleapt and the natural region, including the densely forested western and south-western slopes of the hills, be searched. Hampson confined himself, it would seem, to the Nilgiri District, the boundary of which, above the forests of Nilambur, runs along the hill tops, and does not include that long spur, called the Camel's Hump on the maps, which runs south between Vayittri and Nilambur. Again, while the District includes the eastern part of the Wynaad, the natural region would take in the western part including the Vayittri Ghat to Calicut. This arbitrary exclusion of large parts of the natural area probably accounts for the absence of many, if not most, of the species in this exclusive Coorg list. It may be observed that the Coorg boundary on the west and south-west runs along the foot of the hills and so takes in the forest where most of the rare species are to be found. I may particularise *Amblypodia bazaloides*, *Amblypodia abseus indicus*, *Gerydus biggsii*, *Kineta microstictum*, as examples of wet forest specimens. *Astictopterus jama mercara* was taken by Col. Winckworth on the Vayittri Ghat: and Col. Fraser and Col. Winckworth took also *Parantirrhoea marshalli* there. *Pathysa antiphates naira*, not recorded from the Nilgiri District, will probably be found within the natural area of the Nilgiris.

THE MEDICINAL AND POISONOUS FERNS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The FILICES are a very large and important family of plants consisting of about 170 genera and upwards of 3,500 species. They are distributed all over the globe, although they find their headquarters in tropical America and tropical Asia. Even the Arctic zone is not excluded. They are found at all elevations, from 10,000 to 12,000 feet in the Tropics, down to the sea level.

The medicinal and poisonous ferns of the world belong to 44 genera:—ACROSTICHUM (Tropical America); ACTINIOPTERIS (North Africa, Mascarene Islands, Persia, Afghanistan, India, Ceylon); ADIANTUM (Cosmopolitan, especially tropical America); ALSOPHILA (South Australia); ASPIDIUM (Tropical regions); ASPLENIUM (Cosmopolitan); ATHYRIUM (Cosmopolitan); BALANTIUM (Cape Verde, Canary Islands, Madeira, Azores); BLECHNUM (Tropical America); BOTRYCHIUM (Cosmopolitan); CERATOPTERIS (Tropical countries); CHEILANTHES (Tropical and temperate regions, xerophytic); CIBOTIUM (Tropical America, Polynesia, Asia); CYCLOPHORUS (Tropical countries); CYSTOPTERIS (Temperate regions); DAVALLIA (South Spain, Portugal, Azores, Madeira, Canary Islands, Cape Verde); DICKSONIA (Australia); DRYMOGLOSSUM (Tropical regions); DRYNARIA (Palaeo-tropics); DRYOPTERIS (Northern temperate regions); GLEICHENIA (Tropical and subtropical regions); GYMNOGRAMME (Central America; xerophytic); HELMINTHOSTACHYS (Ceylon, Himalaya to Queensland); HEMIDICTYUM (India, Western Asia, Europe, North-West Africa); LOMARIA (India, Ceylon, Philippine Islands, Fiji, New Zealand, South Australia, Tasmania); LYGODIUM (Tropical Asia, Eastern Asia); MARSILIA (Europe and subtropical regions); MERTENSIA (Tropical and subtropical countries); MOHRIA (East Africa, Madagascar); NEPHRODIUM (Northern temperate regions); NEPHROLEPIS (Tropical and subtropical regions); NOTHOCLAENA (Subtropical regions, Mediterranean); ONOCLEA (East Asia, North America); OPHIOGLOSSUM (Tropical and temperate regions); OSMUNDA (Temperate and tropical countries); PELLAEA (Subtropical regions); PLEOPELTIS (Tropical and subtropical regions); POLYPODIUM (Tropical and temperate regions); POLYSTICHUM (Moist temperate regions); PTERIDIUM (Cosmopolitan); PTERIS (Cosmopolitan); SCOLOPENDRIUM (Europe, Asia); STENOLOMA (India, Ceylon, Malaya, China, Japan, Polynesia, East African Islands); WOODWARDIA (Tropical and subtropical regions).

The medicinal and poisonous ferns of India belong to the following 24 genera:—ACTINIOPTERIS, ADIANTUM, ASPIDIUM, ASPLENIUM, ATHYRIUM, BLECHNUM, BOTRYCHIUM, CERATOPTERIS, CHEILANTHES, CIBOTIUM, CYSTOPTERIS, DRYMOGLOSSUM, DRYNARIA, DRYOPTERIS, GLEICHENIA, HELMINTHOSTACHYS, HEMIDICTYUM, LYGODIUM, Ophioglossum, Osmunda, Pellaea, Pleopeltis, Pteris, Stenoloma.

I. *Gleicheniaceae*—Sori dorsal, without indusium, composed of a few sporangia having a transverse or obliquely transverse complete ring and opening vertically.
Caudex creeping; stipes forked; segments small, almost round or pectinate ... ... Gleichenia.

II. *Dicksonieae*—Sori globose; indusium inferior subglobose, free, closed, at length bursting irregularly, more frequently cup-shaped, entire or with 2 lips.
Indusium apical on a vein 2-valved ... ... Cibotium.

III. *Davallieae*—Indusium squamiform, suborbicular or tubular, open at the apex.
a. Indusium apical, compound, sub-orbicular, only open at the top ... ... Stenoloma.
b. Indusium medial on a vein membranaceous, hood-like ... ... Cystopteris.

IV. *Pterideae*—Indusium oblong or linear, formed of the more or less changed and reflexed margin of the frond, opening inwardly.
a. Indusium globose to linear, usually many and distinct, sometimes confluent and continuous bearing the capsules on its under side; veins free ... ... Adiantum.
b. Indusium rounded and distinct, or more or less confluent but not continuous; capsules on the frond ... ... Cheilanthes.
c. Indusium quite continuous, sori at first dot-like, but soon running into a line ... ... Pellaea.
d. Indusium quite continuous; sori linear continuous, occupying a slender filiform receptacle in the axis of the indusium; veins free ... ... Pteris.
e. As in *Pteris*, but veins all anastomosing without free included veinlets ... ... Dryopteris.
f. Anomalous ... ... Ceratopteris.

V. *Blechneae*—Indusium linear or oblong parallel with the midrib and opening towards it, not near the margin.
Indusium membranaceous, distinct from the margin of the frond, parallel with and usually contiguous to the midrib, veins free ... ... Blechnum.

VI. *Asplenieae*—Indusium linear or oblong or horseshoe-shaped, opening towards the midrib, sometimes double; sori attached to the veins.
a. Indusium linear or oblong, single; vein free ... Asplenium.
b. Indusium linear or oblong, more or less curved. Athyrium.
c. Indusium linear or oblong; veins anastomosing obliquely only towards margin of frond ... Hemidictyum.
d. Indusium linear elongated, submarginal, fronds fan-like ... ... Actiniopteris.

VII. *Aspidieae*—Indusium superior, elliptical, subglobose or reniform, fixed either by the centre or a sinus.
Indusium peltate, orbicular or reniform; veins copiously anastomosing with free included veinlets ... Aspidium.

VIII. *Polypodieae*—Sori on the back of the lobes, round or rarely somewhat oblong.
a. Fronds with the base oak-leaf-like or with separate sterile oak-leaf-like small fronds ... ... Drynaria.

	b. Fronds various; veins copiously anastomosing with free included veinlets	Pleopeltis.
IX.	*Grammitideae*—Sori on the back of the lobes more than twice as long as broad, usually linear.	
	Sori in a continuous linear, or interrupted central or submarginal line, veins reticulated, fronds simple and dimorphous	Drymoglossum.
X.	*Osmundaceae*—Capsules 2-valved, opening across the apex, furnished with a short horizontal ring ...	Osmunda.
XI.	*Schizaeaceae*—Capsules 2-valved, opening down the side crowned by a complete operculiform ring.	
	Capsule solitary in the axils of large imbricating clasping involucres. Scandent	Lygodium.
XII.	*Ophioglossaceae*—Capsules deeply 2-valved, opening down the side nearly to the base without a ring.	
	a. Capsules sessile in 2 rows on a narrow close spike	Ophioglossum.
	b. Capsules in small crested clusters forming a loose spike	Helminthostachys.
	c. Capsules in 2 rows on the face of spikes which form a compound panicle	Botrychium.

The parts used medicinally are the fronds and the rhizomes. The former are often aromatic, and they are commonly given in infusion for their mucilaginous, pectoral, and astringent properties. On the other hand, the rhizomes usually contain a bitter astringent principle together with a fixed oil which is poisonous to worms.

The common Male Fern, or Shield Fern, which has been known from the times of Theophrastus and Dioscorides as a specific remedy for intestinal worms, particularly the tape worm, is official in all pharmacopoeias. The true Maidenhair Fern is official in Belgium, Portugal, Switzerland, and Turkey. The Canadian Maidenhair and the common Hart's Tongue are recognized by the French Codex, and several species of Polypody Ferns are still retained in the Austrian pharmacopoeia.

Actiniopteris.

This genus consists of a single species, ***A. dichotoma*** Bedd., which resembles a miniature palm. It is found throughout India, epecially the Peninsula, in dry rocky places, below 4,000 ft. From Ceylon to the Mascarene Islands, Maarlisberg, Zambesiland, Angola, Upper Egypt, Abyssinia, Socotra, Mount Sinai, Arabia, Persia, Afghanistan.

It is used medicinally as a worm remedy, and as an astringent to arrest hemorrhage.

Bombay: Bhuitad, Mapursika, Mayursikha—; *English*: Peacock's Tail—; *North-Western Provinces*: Morpach, Morpankhi—; *Sanskrit*: Mayurshikha—.

Adiantum.

This cosmopolitan genus numbers about 190 species, mostly tropical American.

Tradition has attributed to various species of this genus of ferns valuable properties in chronic pulmonic catarrhs.

The following species are used medicinally in Europe, Indo-China, Mexico—*A. capillus-veneris* Linn.—; in China—*A. capillus-veneris* Linn., *A. flabellulatum* Linn., *A. monochlamys* Eat.—; in North America—*A. capillus-veneris* Linn., *A. pedatum* Linn.—; in Brazil—*A. cuneatum* Langsd. and Fisch., *A. radiatum* Linn., *A. subcordatum* Sw., *A. tenerum* Sw.—; in South Africa and La Reunion—*A. capillus-veneris* Linn., *A. aethiopicum* Linn.—.

The fronds of *A. pedatum* Linn. are officinal in France; those of *A. capillus-veneris* Linn. in Belgium, Portugal, Switzerland, Turkey.

Nine therapeutically active species may be found growing in India.

I. Frond simply pinnate, rachis rooting at the apex.

a. Pinnae half-moon shaped, distinctly stalked, ¾-½ inch by 1½-1 inch. Texture herbaceous 1. *A. lunulatum.*

b. Pinnae wedge-shaped at the base, nearly sessile, ½-¾ inch by ¼ inch. Texture leathery ... 2. *A. caudatum.*

II. Frond at least bipinnate; segments fan-shaped with the stalk near the centre; sori oblong or obversely kidney-shaped.

a. Pinnules firm, membranaceous-chartaceous, glabrous, scarcely ever or but slightly 2-3 lobed, fertile lobes with 2, rarely 3 notches, each notch bearing a rather large sorus at the bottom ... ... 3. *A. venustum.*

b. Sori roundish or transversely oblong.

i. Pinnules distinctly wedge-shaped at the base. Sori in shallow depressions of the lobes.

† Pinnules deciduous ... ... 4. *A. tenerum.*

†† Pinnules not deciduous ... .. 5. *A. capillus-veneris.*

ii. Pinnules roundish, being straight, almost wedge-shaped or rounded at the base. Sori in deep hollows of the lobes ... ... 6. *A. aethiopicum.*

c. Sori obversely kidney-shaped in deep round hollows of the lobes ... ... 7. *A. cuneatum.*

III. Frond dichotomous ... ... 8. *A. pedatum.*

IV. Frond flabellate ... ... 9. *A. flabellulatum.*

1. **Adiantum lunulatum** Burm. This very graceful fern occurs throughout Northern India in moist places; in South India it is very general on the western side in the plains and lower slopes of the hills. It is found in Burma, Ceylon, the Malay Peninsula, Perak, Cochin-China, China, Hongkong, Polynesia, Tropical Australia. It extends to Cape Verde Isles, Angola, Guinea, Zambesiland, Madagascar. In Tropical America it grows from Mexico southward to the Organ Mountains in Brazil.

Ayurvedists describe the plant as pungent, cooling, alterative, alexiteric, and indigestible. They consider it useful in dysentery, diseases of the blood, ulcers, erysipelas, burning sensations, and epileptic fits. They recommend the rhizome for strangury and for fever due to elephantiasis.

In general the fronds are considered to be deobstruent, diuretic, emmenagogue, resolvent and pectoral. As a pectoral they are used in pulmonary catarrh. They are also demulcent and mildly stimulant. As a discutient their plaster is a useful application on chronic gouty and other swellings. Burnt with oil they are used as an application for itch.

In Gujerat the plant is extensively used in the treatment of children for febrile affections. The leaves are rubbed with water and given with sugar. The herbaceous parts pounded with ochre are applied topically for erysipelatous inflammations.

Arabic: Shirulajibala—; *Bengal*: Goyalelata, Kalijhant—; *Bombay*: Hansraj, Hansaraj, Kombada, Mubarak, Ratakombada, Rajahans—; *Canarese*: Navalad—; *Gujerati*: Hanspadi, Hansraj, Mubarkha, Mubarkhinipalo—; *Hindi*: Hansapadi, Hansapagi, Kalijhamp, Kalijhant, Paresiyavasan—; *Ilocano*: Dalipaco—; *Marathi*: Ghodkhuri, Hansari, Kamsaraj, Rajhans—; *Persian*: Parasiyavashana—; *Philippines*: Culantrillo—; *Porebunder*: Hansraj, Kalohansraj—; *Sanskrit*: Brahmadani, Chitrapada, Dharttarashtrapadi, Ghritamandalika, Godhangri, Godhapadika, Hansaghri, Hansapadi, Hansavati, Karnati, Kiramata, Kirapadika, Kitamari, Madhusrava, Padangi, Raktapadi, Sancharini, Shitangi, Sutapadika, Suvuka, Tamrapadi, Tridala, Tripadi, Triphala, Vikranta, Vishvagranthi—; *Tagalog*: Caicai, Gayomanmanoc, Lamotlamotan, Lomotlomotan—.

2. **Adiantum caudatum** Linn. occurs throughout India, Ceylon, and the Malay Peninsula in the plains and lower slopes of the hills. It extends to Java, Borneo, the Philippine Islands, China, and Arabia Felix. It is also found in the Cape Verde Islands, the banks of the Niger, Angola, Zambesiland, the Cape Colony, and Mauritius.

The fronds are used as a cure for cough and fever. They are also employed externally as a remedy for skin diseases.

Cutch: Mayurshika—; *Punjab*: Adhsaritakajhari, Gunkiri—; *Sanskrit*: Mayurashikha—.

3. **Adiantum venustum** Don. is a common Himalayan fern distributed from Afghanistan, through Kashmir and the Punjab, to Nepal. Blanford says this is 'one of the commonest and most abundant ferns of Simla, covering banks and sloping ground in shady places, and ranging from 4,500 ft. up to the top of Hattu at 10,500 ft.' It grows in the soil in forest, often forming for miles the most characteristic under-vegetation.

This maidenhair is a famous Yunani drug, and at one time it used to be exported in cartloads from Jaunsar, along the cart-road to Saharanpur, for some medicinal purpose. Mahommedan writers describe the fronds of the plant as slightly bitter, resolvent, deobstruent, expectorant, diuretic, emmenagogue, purgative, aphrodisiac, and alexipharmic. They consider them useful in biliousness, phlegmatic humours, inflammations, diseases of the chest, colds, headache, tumours, ophthalmia, and hydrophobia. They prepare an oil which they apply to piles, tuberculous glands, and wounds, and also 'to bring out a thorn which has penetrated into the body'. The leaves made into a plaster are applied topically to chronic tumours of various kinds.

There is no doubt as to this fern possessing astringent and aromatic properties, and being emetic in large doses. It is a tonic, febrifuge, and expectorant. The plant is very useful as a mild tonic, especially during convalescence from fevers. A vapour bath medicated by a decoction from the leaves of this fern is regarded as useful in fever.

In Chamba the plant is pounded and applied to bruises.

It is this fern which supplies in the Punjab most of the *hansraj* which is commonly administered as an anodyne in bronchitis, and is considered diuretic and emmenagogue.

As an ointment it is used for the prevention of hair from falling. The ashes of the plant mixed with olive oil and vinegar are used to make the hair grow upon the bald patches produced by ringworm of the scalp.

The plant is one of the ingredients in Sushruta's Vidaryadi-gana recommended for the treatment of scorpion sting. On the other hand Yogaratnakara, Nighantaratnakara, and Brihannighantaratnakara advise macerating the rhizome and putting the juice and pulp into the ear of the patient. But from their experimental work with mice Caius and Mhaskar have concluded that no part of the plant is an antidote to scorpion venom.

Arabic: Kuzburatelbir, Masifelaswad, Sakelasward, Shaerelfual, Shaereljibal, Shiruljibal, Shiruljinn—; *Bombay*: Mubarak—; *Hindi*: Hansraj, Kalijhanp, Kalijhant—; *Persian*: Hansraj, Paresiyawashan, Parsiawashan—; *Sanskrit*: Hansapadi—; *Tamil*: Mayirsikki—; *Urdu*: Mobarkha, Parsia ushan—.

4. **Adiantum tenerum** Sw. is found in Mexico and the West Indian Islands, southwards to Juan Fernandez and Peru. One solitary specimen was collected in Sion Wood, Bombay Island, by Blatter and d'Almeida, and regarded as an escape from cultivation.

The plant is demulcent, expectorant, and sudorific. It is much used in Brazil in bronchial and catarrhal affections.

5. **Adiantum capillus-veneris** Linn. appears to be found all over India, where circumstances are favourable; shade and permanent moisture being essentials. It occurs chiefly in the Western Himalaya, ascending to an altitude of 8,000 ft.; but found also far to the east in the valley of Manipur, extending to the mountains of the Burma-Manipur frontier and to Chittagong. It is common in the Punjab, descending even to the plains, where it is found in wells and damp places. It is also quite common in South India, in the Bombay and Madras Presidencies, particularly on the west side up to 5,000 ft. It is rare in Ceylon, but extends to Polynesia, Japan, and South-Eastern China. Through Afghanistan and Baluchistan it finds its way to Arabia, Syria, Siberia, the Caucasus, Central and Southern Europe, South-West England, Isle of Man, and Ireland. It is also met with in the Canary Islands and in many parts of the African Continent, both North and South. It extends from Florida, southward to Venezuela and the Amazon Valley.

In the Punjab, the leaves along with pepper, are administered as a febrifuge; and in South India, when prepared with honey, they are used in catarrhal affections.

The herb is mucilaginous, pectoral, and expectorant; and is used as a popular cough medicine throughout most parts of

Europe. It has also been used to stimulate menstrual discharges. It is given in the form of infusion, sweetened with sugar or honey.

In France large quantities are employed in the preparation of *Sirop de Capillaire*, which is given as a favourite medicine in all coughs, throat affections, and bronchial disorders. It is flavoured with orange flowers, and acts as a demulcent with slightly stimulating effects. One part of the plant is gently boiled with ten parts of water, and with nineteen parts of white sugar. Dr. Johnson, says Boswell, used to put *Capillaire* into his port wine. Sir John Hill used to say that the fine syrup made in France from that Fern is not by any means to be thought a trifle, because barley water, sweetened with this, is one of the very best remedies for a violent cold.

'The True Maidenhair,' says Gerard, 'maketh the hair of the head and beard to grow that is fallen and pulled off.'

The Basutos smoke the leaf for head and chest colds.

In Southern California the plant is much used as an astringent, expectorant, and emmenagogue.

At Colomas, in Mexico, the leaf is used as a tea to relieve colic; but at Colothan it is taken as a tea for the absence or abnormal stoppage of the menses.

The rhizome is the part used in Persian medicine; it is credited with expectorant properties and is given for relieving difficult respiration.

Arabic: Shairuljin, Shiruljin—; *Catalan*: Capillera, Falsia—; *Colombia*: Cilantrillo, Culantrillo—; *Dutch*: Venushaar, Vrouhenhaar—; *Egypt*: Kuzbaret-el-bir—; *English*: Maidenhair Fern, Maria's Fern, Our Lady's Hair—; *French*: Adiante, Adianthe, Capillaire, Capillaire commun, Capillaire d'Italie, Capillaire de Montpellier, Capillaire vrai, Cheveux de Vénus—; *German*: Frauenhaar, Venushaar—; *Greek*: Adianton—; *Gujarati*: Hanspadi—; *Hindi*: Hansraj, Mubaraka, Pursha—; *Indo-China*: Duoi chon, Thiet tuyen thao—; *Italian*: Adianto, Capelvenere, Capillare, Capilvenere—; *Kashmir*: Dumtuli—; *Kumaon*: Mubaraka—; *La Reunion*: Capillaire—; *Lepcha*: Luk-sip, Ruksip—; *Malta*: Maidenhair, Capelvenere, Tursin il Bir—; *Pacific Coast*: Black Maiden's-hair, Lady's hair, Maidenhair, True Maiden's-hair, Venus's-hair Fern—; *Persian*: Barr-i-sija waschan, Kashburat-el-bir, Parsia washan, Pusia wechame, Sirsiapeshane—; *Portuguese*: Avenca, Cabellos de Venus, Capillaria, Herva capillar—; *Roumanian*: Chica-voinicului, Perul fetei, Perul sfantei Marii, Vergura invelita—; *Russian*: Adiant, Krasnyi jenskiy volos—; *Salt Range*; Parasigavashan, Parshavarsha—; *Spanish*: Capilera, Capilera de Mompeller, Culantrillo de pozo—; *Suto*: Pata-lewana, Pata-mawa—; *Teheran*: Kashburat—; *Trans-Indus*: Bisfaif, Kirwatzei—; *Turkish*: Baldirikara—.

6. **Adiantum aethiopicum** Linn. (=*A. emarginatum* Bedd.) is found in North Kanara, and at the higher elevations on the Nilgiris, and the Pulney Hills. It extends to Ceylon, Australia, New Zealand, La Reunion, Madagascar, Cape Colony, Natal, Zambesiland, the Cameroon Mounts up to 7,000 ft., Abyssinia, Spain, and Afghanistan. It also occurs from Texas and California southward to Valparaiso and Montevideo.

An infusion of the leaves is commonly used as an emollient in coughs and diseases of the chest.

At La Reunion the plant is a popular cough medicine, and much used as a sudorific.

In Basutoland a decoction of the caudex is used to promote parturition. The natives smoke the leaf for colds in the head and the chest.

Afrikaans: Vrouehaar—; *South Africa*: Large Maidenhair—; *Suto*: Maorumetsoo, Pata-lewana, Pata-mawa—.

7. **Adiantum cuneatum** Langs. and Fisch. is a native of Brazil, very common in cultivation. It runs into many varieties and is difficult to identify.

In Brazil the leaves are a popular cough medicine. The plant is considered a good sudorific.

8. **Adiantum pedatum** Linn. grows all along the Himalayas from Kashmir to Sikkim; scattered, and not plentiful. It extends to China, Manchuria, Japan. It is found abundantly from Unalashka and Canada, southwards to Virginia and California, in wet lands and woods.

The plant is employed in France and North America as a pectoral in chronic pulmonic catarrhs. It is also said to be endowed with astringent and emmenagogue properties.

English: Canadian Maidenhair—; *French*: Capillaire du Canada—; *Pacific Coast*: American Maidenhair, Hair Fern, Rock Fern—; *Spanish*: Capilera del Canada, Culantrillo del Canada—.

9. **Adiantum flabellulatum** Linn. is very common in some parts of India: Nepal, Assam, Khasia, Sylhet. It is found in the Ouvah District of Ceylon, in the Malay Peninsula and the Malay Archipelago, Southern China, Japan.

The rhizome is used as an anthelmintic in the Manipur State and in Annam.

The herb is used in China as a cough medicine.

Annam: Thiet tien thao—; *Chinese*: T'ieh Hsien Ts'ao—.

ASPIDIUM.

The genus consists of 50 species distributed throughout the Tropics.

The following species are used medicinally in Europe—*A. fragile* Sw., *A. roeticum* Linn.—; in China— *A. falcatum* Sw.—; in North America—*A. marginale* Sw., *A. spinulosum* (Mill.) Sw., *A. trifoliolatum* Sw.—; in South Africa—*A. aculeatum* Sw. var. *pungens* Klf., *A. athamanticum* (Hook.) Kuntze—.

Of the numerous species found growing in India, two are therapeutically active:—

I.	Indusium orbicular, veins generally anastomosing acutely with free veinlets from their junction; fronds 1-2 ft. long by 6-9 in. broad; sori small copious, scattered ...	1. *A. falcatum.*
II.	Indusium often quite absent, peltate orbicular, or reniform, veins copiously anastomosing with free included veinlets; fronds 1-4 ft. long by 1 ft. or more broad; sori on the netted veins, small and scattered in the uncontracted fronds, large and more or less in two rows between the main veins in the contracted ones.	2. *A. polymorphum.*

1. **Aspidium falcatum** Sw. grows in North-Western India and extends from Kashmir and the Punjab to Sikkim and Bhutan, Assam and the Khasia Mountains without being common any-

where; also in the Nilgiris at the higher elevations. It is found in China, Japan, the Sandwich Islands, Caffraria, Natal, and Madagascar.

The Chinese use the rhizome as an anthelmintic, chiefly for the expulsion of the tapeworm.

Chinese: Kuan Chung—.

2. **Aspidium polymorphum** (Wall.) Bedd. grows in the western forests of the Madras Presidency up to 4,000 ft.; in Northern India from Garhwal to Mishmee and Chittagong; in Burma, Ceylon, the Malay Archipelago, the Philippine Islands, and Fernando Po.

The rhizome is used as an anthelmintic.

ASPLENIUM.

This cosmopolitan genus numbers 540 species.

The following species are used medicinally in Europe—*A. adiantum-nigrum* Linn., *A. ruta-muraria* Linn., *A. trichomanes* Linn.—; in La Reunion—*A. adiantum-nigrum* Linn.—; in South Africa—*A. adiantum-nigrum* Linn., *A. cuneatum* Linn., *A. furcatum* Thunb., *A. monanthemum* Linn., *A. trichomanes* Linn.—; in Brazil—*A. regulare* Sw., *A. sulcatum* Lam.—.

Five therapeutically active species are met with in India:—

I. Fronds pinnate.	
a. Fronds 6-12 in. long, about $\frac{1}{2}$ in. broad; sori linear oblong, 3-6 on each side of the midrib	1. *A. trichomanes.*
b. Fronds 6 in. long to 2 ft. long or more, 4-8 in. broad; sori in long irregular lines reaching nearly to the margin	2. *A. falcatum.*
II. Fronds bi-quadripinnate.	
a. Fronds 1-2 in. long, about 1 in. broad; sori copious	3. *A ruta-muraria.*
b. Fronds 6-12 in. long, 4-6 in. broad at the base; veins obscure, oblique; sori copious ...	4. *A. adiantum-nigrum.*
c. Fronds coriaceous 6-18 in. long, 4-6 in. broad; veins flabellate, deeply channelled; sori linear	5. *A. furcatum.*

1. **Asplenium trichomanes** Linn. is a common Himalayan fern occurring from Afghanistan to Kumaon at altitudes of 5,000-11,000 ft. It is very common from 5,000 to 9,000 ft. in the Simla Region. It has been found in South India at Kulhatty on the Nilgiris. It occurs in Japan, Java, Australia, Tasmania, and New Zealand, sub-arctic Greenland, Canada and westward to the Rocky Mountains, British Columbia, the United States, Bermuda and southward to Panama, the West Indies Islands, and from Guiana and Venezuela to Bolivia.

This is the common Maidenhair of the British Isles, distributed over the continent of Europe 'throughout its length and breadth, from Iceland and Lapland to the Rock of Gibraltar; throughout the Mediterranean Region; and from the extreme west of Ireland to the extreme east of Europe', Siberia and Persia. It thrives equally well in the Azores and the Macaronesian Isles, Algeria, Morocco, Abyssinia, Somaliland, the Ruwenzori Mountain of Central Africa, and the Cape of Good Hope.

Its leaves are sweet, mucilaginous, and expectorant, being therefore highly useful in many pulmonary disorders. A tea brewed from them is one of the common English remedies for a violent cold and for tedious coughs. 'We have the common Maidenhair, which grows on old walls, and which will act as a laxative medicine; whilst idiots are said to have taken it remedially, so as to recover their senses.'

In Basutoland the leaf is smoked for colds in the head and chest.

Catalan: Falsia roja—; *English*: Common Spleenwort, Maidenhair—; *French*: Polytric des officines—; *German*: Rotes Frauenhaar—; *Languedoc*: Fau capillero—; *Spanish*: Politrico—; *Suto*: Lehorometso—; *Tamil*: Mailakkondei—.

2. **Asplenium falcatum** Lam. is found in the western mountains of the Madras Presidency, in Ceylon, the Malay Peninsula, Australia, Polynesia, South Africa and its islands.

In Goa and Malabar the plant is used as an alterative in cases of prolonged malarial fever.

Bombay: Pana—; *Goa*: Pandan—; *Malayalam*: Nelapannamaravara—.

3. **Asplenium ruta-muraria** Linn. is common in Afghanistan and extends through Kashmir and Baltistan as far as West Nepal, with a gap between West Kashmir and Kumaon. It is found in Turkish Armenia, the Ural Mountains to Caucasus, Turkestan, Tibet, and Siberia, Algiers, the Cape Colony, and many parts of the United States. It is distributed all over Europe: from Arctic Regions, to Spain and Portugal, Italy, the Mediterranean Isles, Greece, and Turkey.

This small herb is still used to some extent in England as a deobstruent and expectorant.

'The Wall Rue is likewise good for them that have a cough, or are shortwinded, or be troubled with stitches in the sides. It stayeth the falling or shedding of the hair, and causeth them to grow thick, fair, and well coloured. Also it helpeth ruptures in children.'

The Fern has been called Tentwort, from its use as a specific or sovereign remedy for the cure of rickets, a disease once known as 'the taint'.

In China it is considered a valuable medicine for the treatment of pulmonary diseases.

Catalan: Falsia blanca, Ruda de rata—; *Chinese*: Koui Ts'ang—; *English*: Tentwort, Wall Rue—; *French*: Capillaire blanc, Doradille des murailles, Rue des murailles, Sauve-vie—; *German*: Weinkraeutel—; *Spanish*: Calantrillo blanco mayor—.

4. **Asplenium adiantum-nigrum** Linn. is found in Afghanistan and Kashmir, at 5,000-8,000 ft., extending to Dalhousie and Chamba. It occurs in Java, the Sandwich Islands, Azores, Canaries, Madeira, Cape Verde Isles, St. Helena, Mascarene Isles, Cameroon Mounts, Algeria, Abyssinia, Natal, the Cape Colony. It is distributed all over Europe—the United Kingdom, Norway and

Denmark, through Holland, Belgium, Germany, France, Switzerland, Austria, Spain, Portugal, Mediterranean Region, Greece, Turkey— and Northern Asia—Armenia, Syria, Arabia, Persia, and Siberia—.

Yunanists describe the plant as bitter, diuretic, laxative, lessening inflammations and abating hiccough, producing sterility in women. They consider it useful in the treatment of ophthalmia and diseases of the spleen.

A decoction or syrup of the fronds is used as an expectorant, pectoral, and emmenagogue in Europe.

The rhizome is used as an anthelmintic in Basutoland.

Catalan: Falsia negra—; *English*: Black Spleenwort—; *French*: Capillaire noir—; *La Reunion*: Capillaire noir—; *Spanish*: Capilera negra—; *Suto*: Lehorometso—.

5. **Asplenium furcatum** Thunb. is common on the higher western mountains of South India, and in Ceylon at 5,000-7,000 ft. It is found in Tropical America, the Polynesian Islands, Australia, Cape Colony, Abyssinia, the Mascarene Islands, and Canaries.

The rhizome is used as an anthelmintic in Basutoland.

Suto: Lehorometso—.

ATHYRIUM.

This cosmopolitan genus numbers 120 species.

Athyrium filix-foemina Roth. is found all along the Himalayas from Afghanistan to Sikkim, at 6,000-13,000 ft., and extends to Sind and the Bombay Presidency. It occurs throughout Europe from Lapland, Russia and Scandinavia to Spain, Portugal, Italy, Greece, Crete, and the Caucasus. From Japan and Kamschatka it crosses to Sitka and Labrador, Canada, British Columbia, the United States, Cuba, Caraccas and Venezuela. It is also met with in the Azores and Macaronesian Isles, Algeria, the mountains of Cameroon, Abyssinia, and Natal.

The rhizome is supposed to possess vermifugal properties similar to those of the male fern for which it is used as an occasional substitute.

In Germany the rhizomes of this fern are frequently found mixed with those of the true male fern.

Catalan: Falguera femella—; *Spanish*: Helecho hembra—.

BLECHNUM.

This genus consists of about 60 species, mostly tropical American.

Blechnum orientale Linn. is found throughout India, Ceylon and the Malay Peninsula, up to 6,000 ft. in the south, and 4,000 ft. on the Himalayas. It extends to the Malay Islands, China, Polynesia, and Australia.

The rhizome is used in China as an anthelmintic.

Cantonese: Kun chung—; *Chinese*: Kuan Chung—; *Malaya*: Koon choong—.

BOTRYCHIUM.

A cosmopolitan genus consisting of about 40 species, three of which are credited with medicinal properties.

I.	Stipes erect, smooth, cylindrical, hollow, succulent; vernation plicate or folded straight; the fertile branch clasped by the sterile before unfolding, pinnate or bipinnate	1. *B. lunaria.*
II.	Stipe 1-2 in. long; petiole of the sterile segment 2-8 in. long, the latter 3-6 in. each way; fertile peduncle up to 18 in. long, generally considerably over-topping the sterile segment	2. *B. ternatum.*
III.	Stipes 3-8 in. long; sterile portion not prolonged beyond the fertile spike 4-12 in. each way; fertile branch of the rachis springing from the base of the sterile portion or from the middle of it	3. *B. virginianum.*

1. **Botrychium lunaria** Sw. is profuse in Afghanistan at 9,000-10,000 ft., common from Kashmir to Sikkim ascending up to 13,000 ft., and extending to the Karakoram Range in Western Thibet. It is found in South Australia, Tasmania, New Zealand, Japan, Kamschatka, Greenland, Newfoundland, Canada, British Columbia, New York, Lake Superior, Colorado, Patagonia, Iceland, Arctic Russia, Livonia, Lithuania and Caucasia, the British Isles, Spain, Italy, Switzerland and the Mediterranean Isles.

The plant is considered a good vulnerary. It is also much used in dysentery.

'This herb is cold and drying, and is available for wounds both outward and inward. The leaves boiled in red wine, and drank, stay immoderate courses and the whites. It stays bleeding, vomiting, and other fluxes. It helps all blows and bruises, and consolidates all fractures and dislocations. It is good for ruptures, and is put into oils and balsams to heal fresh and green wounds.'

English: Moonwort—; *French*: Herbe aux serpents, Petite lunaire—; *German*: Walpurgiskraut—; *Italian*: Vindicta—.

2. **Botrychium ternatum** (Thunb.) Sw. is found in the Himalayas from the Punjab to Nepal and Sikkim, and has been reported from Mount Abu. It extends to Tasmania and New Zealand, Japan, Siberia and Kamschatka, Nootka and Hudson's Bay Territory, Canada, New England, westwards to California, Washington, and southwards to Florida, hence to New Grenada. In Europe it occurs in Lapland, Hungary, and the Pyrenees.

The plant is used as a vulnerary in China; and the root is prescribed in dysentery.

Chinese: Yin Ti Chueh—; *Indo-China*: Am dia guyet—.

3. **Botrychium virginianum** Sw. occurs in the Himalayas from the Punjab to Sikkim. It is found from Norway to Austria, in Ecuador and Brazil, from New Brunswick to Florida, and westwards to Arizona and the Pacific Coast—British Columbia southwards to Oregon.

The fleshy root is used by American Indians in application to cuts and bruises.

Pacific Coast: Grape Fern, Moonwort, Rattlesnake Fern—.

CERATOPTERIS.

The only species known, **C. thalictroides** Brong., is found throughout India, Ceylon, and the Malay Peninsula up to 3,000 ft. elevation; common in tanks, ditches, and swampy places, or even dry ground during the rains. It extends to the Great Coco Island, the Nicobar Islands, Java, the Philippine Islands, Japan, China, Hongkong, South Florida, Mexico, and the West Indies southwards to Brazil. It also occurs in Arabia Felix and South-Eastern Arabia; and is found in Tropical West Africa, Angola, and Madagascar.

The plant is used in China as a tonic and styptic.

Chinese: Shui Chueh—.

CHEILANTHES.

The genus consists of 120 species, inhabiting tropical and temperate regions.

C. hirta Swartz. is used medicinally in South Africa.

Cheilanthes tenuifolia Sw. is common in the Madras Presidency, in the plains and on low hills up 4,000 ft. It occurs in Bengal, in the plains of Assam, Chittagong, Dacca, Chota Nagpore, in Khasia up to 5,000 ft., Sikkim, the Malay Peninsula, and the Malay Islands. It extends to China, Australia, New Zealand, Polynesia, and Uruguay.

The Santals prescribe a preparation from the roots for sickness attributed to witchcraft or the evil eye.

Santali: Dodhari, Nanha—; *Tasmania*: Parsley Fern—.

CIBOTIUM.

This genus contains 10 species, inhabiting tropical America, Polynesia, and Asia.

Cibotium barometz Link. (=*C. glaucum* Bedd.) is found in Mishmi, Assam, and Tavoy, extending to the Malay Islands and South China.

The drug consists of the lower part of the caudex, reddish brown in colour, in longitudinal slices, covered on the outside with golden brown moniliform hairs suggesting the fur of an animal. The hairy rhizome thus sometimes resembles a lamb, hence the specific name *barometz*, Russian for lamb. It is the Agnus Scythicus, or Tartarian or Vegetable Lamb, a drug of great repute alluded to in medical works of the sixteenth and seventeenth centuries.

The root is employed in China as a tonic, and is said to exercise a special action on the genito-urinary organs. It is also given for lumbago.

In Annam the stems are considered tonic and styptic. The rhizome, like other fern roots, is used as a vermifuge.

The golden brown hair from the base of the fronds is used in Malaya, Java and Sumatra for stanching wounds. It has the power of causing rapid coagulation of blood, and, when properly used, of mechanically arresting hemorrhages from capillaries. It has been much used in the physiological laboratories of Europe and America, and was employed in human medicine during the Middle Ages.

Annam: Bach chi, Cau quyet, Cau thank, Cau tich, Cay cu lan, Cay cu li, Cay cu lon, Cay ku lien, Cay tien phuong vi, Cuong lu, Cu seoga, Kim Mao, Phu can—; *Cantonese*: Kau Tsek—; *Chinese*: Kou Chi, Toei Choun—; *French*: Agneau de Scythie, Agneau de Tartarie, Chien roux, Poil de singe—, *Malaya*: Kow chiak—.

CYSTOPTERIS.

This genus consists of 5 species distributed through the temperate regions of the world.

Cystopteris fragilis Bern. is found in Afghanistan and on the Himalayas from Kashmir to Sikkim ascending to 10,000-15,000 ft. It extends to Australasia, New Zealand, the Sandwich Isles, the Arctic and temperate regions of North America, California, Mexico, and through the whole length of the Andean Chain. It is found in the West Indies, and everywhere in Europe from Iceland and Novaya Zemlya and Spitzbergen in the Arctic Regions to Spain, Sicily, Cyprus and the Caucasus. It also occurs in the Lebanon, Persia, Kurdistan, Siberia, Manchuria, Kamschatka, Tibet, and North China. It is distributed to Madeira, Fernando Po, Abyssinia, and South Africa.

The Sutos of Basutoland use a decoction of the rhizome as an anthelmintic enema.

Suto: Lehorometso—.

DRYMOGLOSSUM.

This tropical genus numbers about 10 species.

Drymoglossum carnosum Hook. is common in Nepal, Sikkim, and Bhutan at 2,000-5,000 ft. elevation. It extends to China and Japan.

The fronds are pectoral, diuretic, and astringent. They are used in China in urinary calculus and rheumatism.

Chinese: Lo Yen Ts'ao—.

DRYNARIA.

This genus consists of 20 species, inhabitants of the Palaeotropics.

Drynaria quercifolia J. Sm. (=*Polypodium quercifolium* Linn.) is found throughout India, in the plains or very low down on the mountains, on trees or rocks.

The Ayurvedists describe the rhizome as bitter, tonic, astringent to the bowels, and useful in the treatment of typhoid fever.

The plant is commonly used in the treatment of phthisis, hectic fever, dyspepsia, and cough.

Ilocano: Capcapa—; *Malayalam*: Pannakilhannumaravala—; *Marathi*: Ashvakatri, Basingh, Wandurbashing—; *Pampangan*: Gona, Tibatib—; *Sanskrit*: Ashvakatri—; *Tagalog*: Pacpaclauin, Paipaiamo—; *Visayan*: Cabcab, Cabcaban, Cabcabun—.

DRYOPTERIS.

This genus numbers 250 species found distributed throughout the northern temperate regions.

It is probable that all of the species of this genus possess more or less anthelmintic properties. The following are commonly used in China—*D. sophoroides* O. Kuntze—; in Japan—*D. crassirhizoma* Nakai—; in North America—*D. marginalis* (Linn.) Asa Gray, *D. rigida* Underw.—; in South Africa—*D. athamantica* (Ktze) O. Kuntze, *D. inaequalis* O. Kuntze.— But by far the most famous species is *D. filix mas* (Linn.) Schott, one of the oldest drugs known, and one which is still retained by all pharmacopoeias.

Dryopteris filix-mas (Linn.) Schott.—MALE FERN—.

The synonyms for the male fern are extraordinarily numerous, and the following are among the better known or more commonly occurring:—*Aspidium filix-mas* of many authors, *A. wildeanum* Goeppert, *Dryopteris filix-mas* (Linn.) Schott, *Lastrea filix-mas* Presl., *Lophodium filix-mas* Newm., *Nephrodium filix-mas* Rich., *Polypodium filix-mas* Linn., *P. nemorale* Salisb., *Polystichum abbreviatum* DC., *P. durum et induratum* Schur., *P. filix-mas* Roth., *Tectarea filix-mas* Cavan. Since the term *Dryopteris* was first used by Amman in 1739, and applied in 1763 by Adamson, as the name of the genus to which the term *Aspidium* was applied in 1800 by Swartz, the use of the generic term *Dryopteris* would seem to be necessitated by the laws of botanic nomenclature.

The Male Fern is of very wide distribution, occurring in America from Greenland, westwards and southwards, along the Rocky Mountains and Andes to Peru. It is found throughout Europe, in North Asia, eastwards to China and Japan. It is also distributed to Abyssinia, the Azores and Macaronesia. In the Indian region it is generally confined to considerable elevations—6,500-11,000 ft.—on the mountains, from the Lowari Pass to Kashmir, Chamba, Kullu, the Simla Region, and Garhwal.

The male fern has been recommended as a local application in eczema and acne. It is, however, as a vermifuge that the drug is better, if not exclusively, known. It is as such that it is mentioned in the works of Dioscorides, Theophrastus, Galen and Pliny, and by some of the earlier modern writers. It is now used in medicine almost solely for the purpose of getting rid of various intestinal parasites, especially the *tapeworm*. As to its value in other forms of helminthiasis there is difference of opinion. Some authors report as many as 75 per cent of cures in cases of *hookworm* infection, but other workers state that the drug has been found absolutely without value in this infection. There has been a great deal of uncertainty as to the efficacy of male fern, especially in tropical climates, and many observers have found it to be not only inefficient and unreliable, but a toxic and a dangerous remedy.

A large amount of chemical work has been done and a number of substances have been isolated from the drug, but the chemical nature of the different constituents is still not clear. This is not surprising as these compounds are unstable bodies and undergo chemical changes in the dry rhizome as well as in the preparations of the oleoresin and the ethereal extract. That is one of the reasons why such widely controversial results have been obtained regarding their physiological activity.

No doubt that the rhizomes of other species of fern are frequently substituted for the 'official', and that in the dried state it is difficult to distinguish them; but which is the official form? A look at herbariums will convince any one that a heterogeneous mass of plants is named *filix-mas*. A talk with the leading pteridologists of the day will further bring home the astounding information that experts are not agreed that even the European forms of *filix-mas* all belong to the same species!

Catalan: Falguera mascle—; *Danish*: Bregne—; *Dutch*: Varen Kruid—; *English*: Male Fern, Shield Fern—; *French*: Fougère mâle—; *German*: Farnkraut, Farnwurzel, Wurmfarn—; *Hungarian*: Erdei pajzsikapapany—; *Italian*: Felce maschio—; *Naples*: Fielici, Filici—; *Norwegian*: Bregne—; *Pacific Coast*: Aspidium, Basket Fern, Bear's Paw, Knotty Brake, Male Fern, Male Shield Fern, Sweet Brake—; *Piedmont*: Fales, Feles, Fleis—; *Portuguese*: Dentebrura, Feto macho—; *Potenza*: Fivece—; *Puglia*: Fidvitti—; *Reggio*: Felsa mas'c—; *Sardinia*: Filighee mas'cia, Filixi maschin—; *Spanish*: Helecho macho—; *Swedish*: Ormbunk, Traejon—; *Treviso*: Felese mas'cio—; *Turkish*: Serhasi müzekker—.

GLEICHENIA.

This genus consists of 25 species inhabiting tropical and subtropical regions.

Gleichenia dichotoma Willd. is found in the mountains of Southern India and Ceylon, up to 6,000 ft., Kumaon, Nepal, Sikkim, and Bhutan, Khasia Hills up to 5,000 ft., Sylhet, Pachmarhi, Tenasserim, South Andamans, the Malay Peninsula, Sumatra, East Timor, Tropical Australia, Japan, America—.

In Annam the rhizome is used as an anthelmintic. In Madagascar the fronds are given as a cure for asthma.

Annam: Hac cot mang, Hac cot phuong, Tieu ly bach—; *Madagascar*: Ampangantsirika—.

HELMINTHOSTACHYS.

The only species, **H. zeylanica** Linn., is found in South India, in the western forests in swampy places up to 3,000 ft. elevation. It also occurs in Ceylon, about Colombo and other parts of the western and southern provinces, in the plains of Bengal to Assam and Cachar. It extends to the Malay Peninsula, the Malay Islands, the Philippine Islands, Tropical Australia, and New Caledonia.

It is regarded in the Moluccas as a mild aperient.

Annam: Quan trong—; *French*: Osmonde de Ceylan—.

HEMIDICTYUM.

This genus consists of 2 species found mostly in temperate regions.

Hemidictyum ceterach Linn. (=*Asplenium ceterach* Linn. =*Ceterach officinarum* Willd.) occurs on the rocks overhanging the

Karriah River in the Kurram Valley, but is rare there. It is very common in Kashmir, Punjab, and Garhwal ascending up to 9,000 ft. It is found in many parts of Germany, in Switzerland, the Tyrol, Hungary, Dalmatia, the Caucasus, Belgium, France, Spain, Italy, Greece. In Britain it is to be seen in all or nearly all the southern, northern, and western counties; 'in Somersetshire and Devonshire it is especially abundant, in Scotland it is much less frequent' chiefly in the west and south-west; it is frequent in Ireland, though local. It extends to Palestine and Persia, the Canaries, Madeira and Cape Verde Islands, Morocco, Algiers, Abyssinia, and the Cape of Good Hope.

'No herbe maie be compared therewith for his singular virtue to help the sicknesse or grief of the spleen', says one of the oldest Herbals. 'It is generally used against infirmities of the spleen, helps the strangury, and wastes the stone in the bladder, and is useful against the jaundice and the hiccough', states Culpeper.

The plant is considered diuretic and astringent. It is still occasionally used in France for diseases of the urinary tract. The rhizome is used medicinally in several parts of Europe for enlargement of the spleen, incontinence of urine, calculus, jaundice, and malaria.

Dioscorides mentions the use of a decoction of the plant in vinegar for enlargement of the spleen, and also the local application of a plaster made of the leaves steeped in wine. Women were not allowed to use it as it was supposed to cause sterility. Pliny ordered 'it should not be given to women, because it bringeth barrenness'.

The rusty-coloured scales under the blades were at one time used as a cure for gonorrhoea.

Catalan: Dauradella, Herba daurada—; *English*: Finger Fern, Miltwaste, Rusty Back, Scaly Fern, Spleenwort, Stone Fern—; *French*: Cétérach officinal, Dauradille, Doradille, Doradille cétérach, Doradille d'Espagne, Herbe dorée, Scolopendre vraie—; *German*: Milzfarn—; *Portuguese*: Douradinha, Escolopendra—; *Spanish*: Capilera dorada, Ceterach, Doradilla—.

LYGODIUM.

This genus numbers 22 species to be found in tropical and subtropical regions.

Two of the species are credited with medicinal properties:—

Pinnules 8-12 in. long, 6-12 in. broad ... ... 1. *L. flexuosum*.
Pinnules smaller, 4-8 in. long, about as broad ... 2. *L. japonicum*.

1. **Lygodium flexuosum** Sw. (=*L. pinnatifidum* Sw.) is very common in the Dehra Dun, Kumaun, Sajahanpur, Gorakhpur; it is abundant throughout the plain in Bengal up to 5,000 ft., and also on both sides of the Madras Presidency up to about 4,000 ft. It extends to Ceylon, the Malay Peninsula, the Philippine Islands, North Australia, Angola, and the Guinea Coast.

The plant is commonly used as an expectorant.

In Tirhut the fresh root is boiled with mustard oil and used externally in rheumatism, sprains, scabies, ulcers, eczema, and cut wounds. It is particularly useful as a local application to carbuncles.

In Indo-China an infusion of the plant is used in blennorrhagia; it is said to be a good lactagogue.

Indo-China: Bong bong, Duong vong, Thach vi day—; *Malayalam*: Vallipanna—; *Tirhut*: Kalazha—.

2. **Lygodium japonicum** Sw. occurs abundantly in North India from Kashmir to Sikkim and Bhutan from 2,000-7,000 ft. elevation. It is rare in the western mountains of South India. It is distributed to Ceylon, Java, the Philippine Islands, China, Japan, and North Australia.

The plant is used as an expectorant in China. It is also used in haematuria and blennorrhagia.

Chinese: Hai Chin Sha—; *Indo-China*: Hai kim sa—.

OPHIOGLOSSUM.

This genus consists of 30 species inhabiting tropical and temperate regions.

Ophioglossum vulgatum Linn. occurs in North India from Chamba State to Sikkim ascending up to 9,000 ft. on Mount Hattu and 2,000 ft. below Darjeeling; it is also found in Chota Nagpore on the Parasnath Mount at an altitude of 2,500 ft. It extends to Japan, the Sandwich Islands, Australia, and New Zealand. It is met with in North America, from Quebec and Ontario southwards to Florida and California, Kentucky, Tenessee, Texas and Arizona to Alaska. In Europe it inhabits Lapland, the British Isles and almost all other countries to Caucasia. In Africa it occurs in the Azores, Abyssinia, the Guinea Coast, Angola, St. Helena, Zambesiland, Cape Colony, and the Mascarene Isles.

A preparation from this plant, known as the 'green oil of charity', is in request in England as a vulnerary and remedy for wounds.

The plant is held in France and Spain as a vulnerary of great repute.

The plant yields a mucilaginous and astringent decoction which is used in angina in La Reunion. The fronds are considered tonic and styptic, and used in contusions, wounds, and haemorrhages.

A warm decoction of the rhizome is used by the Sutos as a lotion for boils.

Catalan: Llansa de Cristo, Llengua de serp—; *English*: Adder's Tongue, Christ's Spear—; *French*: Herbe à daucune, Herbe sans couture, Lance de Christ, Langue de serpent, Luciole, Ophioglosse, Ophioglosse commune, Petite serpentaire, Serpentine—; *Hausa*: Mashinzomo—; *La Reunion*: Herbe un coeur, Herbe paille-en-queue, Langue de serpent—; *Spanish*: Lengua de serpiente—; *Suto*: Mmadiyo, Tsebe-ngwe, Tseyananyane—.

OSMUNDA.

This genus consists of 10 species distributed throughout the temperate and tropical countries of the world.

Fronds 2-4 ft. long, 1 ft. or more broad, bipinnate ...	1.	*O. regalis.*
Fronds 1-2 ft. long, 8-12 in. broad, simply pinnate ...	2.	*O. claytoniana.*

1. **Osmunda regalis** Linn. is common on the western mountains of South India at the higher elevations; it is found in the

Himalayas from the Chamba State to Sikkim and Bhutan, but has become very rare in the Simla region; it is common, or at least frequent, in the Khasia District up to 4,000-6,000 ft., in the Central Provinces, and in the Bombay Presidency. It extends to South and West China, Hongkong, Japan, Canada and the Saskatchewan to Brazil. In Europe it is distributed over the British Isles, Sweden and Russia to Spain, Italy, Turkey, and to Siberia. It is met with in the Azores, Algeria, Tunis, Abyssinia, Angola, Central Africa, Nyassaland, Zambesiland, Natal, Cape Colony, and the Mascarene Isles.

The plant is a well known tonic and styptic, and is still very much employed all over Europe. It is used for rickets in England and in France.

The white centre of the root, boiled in some kind of liquor, was supposed good for persons wounded, dry-beaten, and bruised, or that have fallen from some high place.

The root or rhizome stamped in water or gin till 'the liquor becometh a stiff mucilage, has cured many deplorable pains of the back, that have confined the distracted sufferers close to bed for several weeks.' This mucilage was to be rubbed over the vertebrae of the back each night and morning for five or six days together. Also for rickets, 'take of the powdered roots with the whitest sugar, and sprinkle some thereof on the child's pap, and on all his liquid foods. It maketh a noble remedy without any other medicine.'

The tender sprigs of the plant at their first coming are 'good to be put into balmes, oyles, and healing plasters'.

This is much more effectual than the other ferns, both for inward and outward uses, says Culpeper. It is accounted singularly good in wounds, bruises, or the like; the decoction to be drunk, or boiled into an ointment of oil, as a balsam or balm, and so it is singularly good against bruises, and bones broken, or out of joint, and gives much ease to the colic and splenetic diseases; as also ruptures and burstings.

In Guinea an extract is prepared and is used externally for rheumatism and internally for intestinal griping.

English: Flowering Fern, Osmond Royal, Osmund-the-Waterman, Royal Fern, Royal Flowering Fern, Water Fern—; *French*: Fougère aquatique, Fougère fleurie, Fougère royale, Osmonde, Osmonde fleurie, Osmonde royale—; *Fulah*: Kolo kouli—; *German*: Koenigsfarn, Traubenfarn—; *Hova*: Ampangafenakoho—; *Indo-China*: Vi—; *Languedoc*: Fougeiroux—; *Spanish*: Helecho acuatico, Helecho florido, Helecho real—.

2. **Osmunda claytoniana** Linn. is found growing in the Himalayas from Kashmir to Bhutan at 6,000-10,000 ft. elevation, in the Khasia Mountains up to 4,500-6,000 ft. It also occurs in Canada, Newfoundland, and throughout the United States.

The rhizomes are used as an adulterant for Male Fern in the American market.

PELLAEA.

This genus consists of 40 species found in subtropical regions.

P. calomelanos Link., *P. consobrina* Hook., *P. hastata* (Thunb.) Prantl., *P. involuta* Bkr. are used medicinally in South Africa.

Pellaea calomelanos Link. is found in the Sirmur State, Dehra Dun, Garhwal, Kumaon, ascending up to 5,000 ft. It extends to Angola, Abyssinia, Somaliland, the Ruenzori Mounts, Zambesiland, Mashonaland, Natal, Cape Colony, and La Reunion.

The Sutos use the rhizome as an anthelmintic, and smoke the leaf for colds in the head and chest.

Suto: Lehorometso, Pata-lewana, Pata-mawa—.

PLEOPELTIS.

This genus numbers 35 species distributed throughout tropical and subtropical regions.

Pleopeltis lanceolata Linn. is found on the Nilgiris and higher mountains on the west side of the Madras Presidency, and extends to Assam and Ceylon. It occurs in Tropical America and the West Indies, South Africa and its islands, St. Helena, and the Sandwich Islands.

In Mexico a tea made from the fronds is taken to cure the itch.

PTERIS.

A cosmopolitan genus numbering 160 species.

P. aquilina Linn. is used medicinally in Europe, China, La Reunion—; *P. multifida* Poir. in China—; *P. leptophylla* Sw., *P. palmata* W., *P. pedata* Sw. in Brazil—; *P. buchanani* Bkr. in Basutoland—.

Pteris aquilina Linn. is very common in the Himalayas, common in the Khasia Hills at 2,000-8,000 ft. It extends to the Deccan, the Madras Presidency, Ceylon, Tenasserim, the Malay Peninsula, and eastwards to Australia and New Zealand. It is universal in Europe, except in the extreme north, and never an Alpine plant; its range in the British Isles is said to agree closely with that of corn cultivation, and in the Scottish Highlands it never rises above 2,000 ft. It is found in the Cameroon Mountains and in Abyssinia. In general it may be said to thrive all round the world, both within the Tropics, and in the North and South Temperate Zones.

The rhizome is reputed astringent and anthelmintic.

A decoction of the rhizomes and fronds has been given in chronic disorders arising from obstructions of the viscera and spleen.

'For thigh aches smoke the legs thoroughly with Fern braken.'

'The roots being bruised and boiled in mead, or honeyed water, and drunk, kills both the broad and long worms in the body, and abates the swelling and hardness of the spleen. The green leaves eaten, purge the belly, and expel choleric and waterish humours that trouble the stomach. They are dangerous for women with child to meddle with by reason they cause abortions. The roots bruised and boiled in oil, or hog's grease, make a very profitable ointment to heal wounds, or pricks gotten in the flesh. The powder of them used in foul ulcers, dries up their malignant moisture, and causes their speedier healing.'

Cantonese: K'uet—; *Catalan*: Falguera femella—; *Chinese*: Chueh—; *Dutch*: Groote varen, Varen—; *English*: Bracken, Brakes, Female Fern—;

French: Filipode, Fougère à l'aigle, Fougère commune, Fougère femelle, Fougère impériale, Fruchière, Ptéride—; *German*: Adlerfarn, Farmkrautweiblein, Fluegelfarn, Jesuschristuswurzel—; *Indo-China*: Guyet—; *Ireland*: Fern of God—; *Languedoc*: Feuvé—; *Malaya*: Keat—; *Malayalam*: Tavi—; *Malta*: Bracken, Eagle Fern, Felce aquilina, Felce capannaja, Felicilla, Felicita—; *New Caledonia*: M'Baoue—; *Portuguese*: Feto—; *Punjab*: Dio, Kakei, Kakhash, Lungar—; *Roumanian*: Navalnic pajuriu, Spinarea lupului—; *Russian*: Paporotnik—; *Saora*: Manmarda—; *Spanish*: Helecho hembra—; *Tamil*: Parnai—.

STENOLOMA.

S. chinensis Bedd. (=*Davallia tenuifolia* Hook.) is found in the western mountains of the Madras Presidency at 3,000-6,000 ft.; in the Himalayas from the Simla region to Bhutan at 1,000-7,000 ft., plentiful eastwards; it is common in the Khasia Hills at 1,000-3,000 ft. Central Provinces, Pachmarhi, Ceylon, the Malay Peninsula, Japan. It extends to Polynesia and the Mascarene Islands, being common everywhere.

It is administered internally for chronic enteritis in Mauritius.

Chinese: Wu Chiu—; *English*: Parsley Fern—; *Mauritius*: Petite fougère—.

EARTH-EATING AND SALT-LICKING IN INDIA.

BY

J. F. Caius, S.J., F.L.S., and S. K. Chhapgar, B.Sc.

(St. Xavier's College, Bombay).

Analyses XXXVI-XXXIX

XXXVI. *Soil from Salt-Lick*

Serial No. 49.

Locality—Sironcha Range, Chanda District, Central Provinces.

Collected and sent by—The Deputy Conservator of Forests, South Chanda

Light buff lumps crumbling easily to powder. Powder gritty.

Minerals	4·63	per cent.
Clay	20·14	,,
Sand	73·99	,,
Organic debris	0·51	,,
Moisture	0·11	,,
Fine Earth (20 mesh sieve)	95·325	,,
Insoluble in nitric acid	69·931	,,
Soda (Na_2O)	0·721	,,
Potash (K_2O)	1·277	,,
Magnesia (MgO)	0·385	,,
Lime (CaO)	0·470	,,
Alumina (Al_2O_3)	4·774	,,
Silica (SiO_2) soluble	12·635	,,
Phosphorus (P_2O_5)	1·434	,,
Ferric oxide (Fe_2O_3)	1·584	,,
Moisture and organic matter	2·095	,,

Remarks.—the same as for Salt-lick No. 48.

XXXVII *Soil from Salt-Lick*

Serial No. 234

Locality—Near Latimu River, at an altitude of 4,000 feet, in the Mpika District, Northern Rhodesia

Collected and sent by—Capt. C.R.S. Pitman, Broken Hill, Northern Rhodesia.

Greyish powder and pellets, some of these flinty, with quartz and marble. Powder gritty ; the finer portions soft.

Minerals	12·86	per cent
Clay	30·12	,,
Sand	50·12	,,
Organic debris	0·67	,,
Moisture	1·87	,,
Fine Earth (20 mesh sieve)	85·075	,,
Insoluble in nitric acid	47·344	,,
Potash (K_2O)	1·628	,,
Magnesia (MgO)	0·044	,,
Lime (CaO)	1·594	,,
Alumina (Al_2O_3)	2·218	,,
Carbon dioxide (CO_2)	0·860	,,
Silica (SiO_2) soluble	25·838	,

Phosphorus (P_2O_5)	0·861	,,
Ferric oxide (Fe_2O_3)	0·429	,,
Moisture and organic matter	4·480	,,

Remarks.—1. The soil contains traces of humus, and 2 per cent water-soluble organic and inorganic matter.

2. The lick is frequented by elephants, black rhinoceroses, buffaloes wart hogs, and various antelopes.

XXXVIII. *Soil from Salt-Lick*

Serial No. 23.

Locality—Sonrai Beat, Marora Range, Jhansi Forest Division.

Collected and sent by—The Divisional Forest Officer, Jhansi.

Friable cement-grey lumps with rootlets. Powder gritty; the finer parts soapy.

Minerals	2·03	per cent
Clay	2·34	,,
Sand	88·14	,,
Organic debris	3·10	,,
Humus	0·34	,,
Moisture	2·89	,,
Fine Earth (20 mesh sieve)	94·235	,,
Insoluble in nitric acid	62·425	,,
Soda (Na_2O)	1·824	,,
Potash (K_2O)	3·671	,,
Magnesia (MgO)	0·396	,,
Lime (CaO)	0·621	,,
Alumina (Al_2O_3)	1·960	,,
Silica (SiO_2) soluble	16.173	,,
Phosphorus (P_2O_5)	0·381	,,
Manganese (Mn)	0·063	,,
Ferric oxide (Fe_2O_3)	3·119	,,
Moisture and organic matter	3·941	,,

XXXIX. *Common Earth*

Serial No 24.

Locality—Sonrai Beat, Marora Range, Jhansi Forest Division.

Collected and sent by—The Divisional Forest Officer, Jhansi.

Buffy friable lumps. Powder gritty ; finer parts soft.

Minerals	9·46	per cent
Clay	2·45	,,
Sand	80·63	,,
Organic debris	3·56	,,
Humus	0·40	,,
Moisture	1·59	,,
Fine Earth (20 mesh sieve)	88·563	,,
Insolube in nitric acid	63·484	,,
Soda, (Na_2O)	0·003	,,
Potash (K_2O)	2·760	,,
Magnesia (MgO)	0·413	,,
Lime (CaO)	0·457	,,
Alumina Al_2O_3)	1·004	,,
Silica (SiO_2) soluble	10·267	,,
Phosphorus (P_2O_5)	1·610	,,
Manganese (Mn)	0·147	,,
Ferric oxide (Fe_2O_3)	3·972	,,
Moisture and organic matter	4·389	,,

Remarks : 1. The soil contains 0·003 per cent of sodium chloride, 0·273 percent of water soluble inorganic matter consisting chiefly of colloidal silica and traces of soluble sulphates, and 0·105 per cent of water soluble organic matter.

2. The earth was collected from a plot adjoining Salt-Lick No. 23.

PROCEDURE ADOPTED IN THE ANALYSIS.

By way of answer and request.—The study of salt-licks was started in the *Journal of the Bombay Natural History Society* six years ago in the number of the 31st May 1929. From various quarters at one time or another the question has been asked: 'Why is this investigation into the composition of salt-licks not carried on more energetically?' The answer runs as follows: 'This investigation is from beginning to end a work of chemical analysis, which of its very nature is long and slow, especially when it has all to be done by a couple of workers who can only devote their spare time to the task.'

It is true that certain students interested in this enquiry sent us their analytical results of various salt-licks for comparison with our own, thus showing an interest which was both gratifying and encouraging. It must, however, be remarked that the analytical results which have been forwarded did not prove very helpful. It is well known, indeed, that analyses of the same material made by different analysts sometimes differ materially, even when the analyses are made by skilled analysts of high repute. These differences are commonly due to the use of different analytical methods or to differences of detail in operating the same method.

Thus far the answer to the question why the investigation of salt-licks takes so long.

At the same time, it is a thousand pities that the work is proceeding so slowly; and we do earnestly invite the co-operation of all those who are interested in the subject. In other words we ask for the analytical results of other research workers. This is the request we venture to make.

But, lest those who wish to comply with this request should work in vain and thus waste time and energy, it has been decided on to give a full description of our way of proceeding in the analysis of salt-licks and common earths. It need not be added that any research work carried on according to this method will prove very helpful, and will be gratefully received and duly acknowledged in the *Journal of the Bombay Natural History Society*—for we believe in the good old principle: *cuique suum.*

By way of illustration, results and calculations are given *in extenso* for a sample of common earth from the Sonrai Forest, Marora Range, Jhansi.—Serial No. 24.—Analysis XXXIX.

A. *Preparation of Fine Earth for analysis; and estimation of moisture, minerals, and fine earth.*

About 100 grams of the air-dried earth are weighed out in a beaker, and water is added so as just to cover the earth. The beaker is covered and allowed to stand for 12 hours. At the end of 12 hours, the clayish concretions are entirely broken up into grains, and it is possible by levigation and sieving to separate all the fine earth from minerals.

The suspension and earth contained in the beaker are poured on a brass wire sieve, having 20 meshes per inch, and kept on a dish of about 2 litres capacity. With a wooden spatula, the earth paste, spread on the sieve, is stirred and washed with distilled water from a wash bottle. All the fine earth passes into the dish, while the minerals remain on the sieve. The separation of fine earth and minerals is carried out with 500 cc. of distilled water.

The fine earth suspension is evaporated on a sand bath, and then dried on a water bath. When dry the earth adhering to the sides of the dish is easily removed by light scratching with a nickel spatula. The scraped fine earth is lightly triturated in the dish with a pestle and then completely transferred to a weighed beaker. The fine earth in the weighed beaker, is dried at 100°C. to constant weight.

The minerals remaining on the sieve are also dried at 100°C., transferred to a watch glass and weighed.

The moisture in air dried earth is estimated in another portion of the earth. About 2 grams of the earth are weighed out in a nickel dish, dried at 100°C. to constant weight and the moisture content calculated. From 6 to 8 hours are required for drying the earth at 100°C.

Results :—

Weight of beaker + earth = 163·5900 grams.
Weight of beaker = 60·4356 grams.

∴Weight of earth used = 103·1544 grams.

Minerals :—

Weight of watch glass + minerals = 24·0055 grams.
Weight of watch glass = 14·2428 grams.

∴Weight of minerals = 9·7627 grams.

Hence the percentage of minerals = $\frac{9\cdot7627 \times 100}{103\cdot15} = 9\cdot46.$

Fine earth :—

Weight of beaker + fine earth = 151·7888 grams.
Weight of beaker = 60·4356 grams.

∴Weight of fine earth = 91·3532 grams.

Hence the percentage of fine earth = $\frac{91\cdot353 \times 100}{103\cdot15} = 88\cdot563$

Moisture :—

Weight of nickel dish + earth = 52·0673 grams.
Weight of nickel dish = 49·5644 grams.

∴Weight of earth = 2·5029 grams.
After drying at 100°C.
Weight of nickel dish + earth = 52·0282 grams.
Weight of nickel dish = 49·5652 grams.

Weight of dry earth = 2·4630 grams.
Hence weight of moisture = 2·5029 − 2·4630 = 0·0399 grams.

Hence percentage of moisture = $\frac{0\cdot0399 \times 100}{2\cdot5029} = 1\cdot59.$

B. *Mechanical analysis* (Schloesing's method). *Estimation of sand, organic debris, clay, and humus.*

About 10 grams of fine earth are weighed out in a porcelain dish of about 100 cc. capacity and moistened with 5 to 10 cc. of distilled water. The paste is broken up with a rubber tipped glass rod and 20 to 30 cc. of water are then added. The mixture is kneaded, allowed to stand for about 10 seconds and the supernatant turbid liquid is decanted in a 250 cc. beaker. To the sediment in the dish 30 cc. of water are added and after kneading and waiting for 10 seconds, the turbid liquid is decanted as before. The operation is repeated till the distilled water mixed with the heavy sediment in the dish does no longer become turbid. *By these operations the clay with fine sand is transferred to the beaker.*

The heavy sediment in the dish, is treated with nitric acid (1 part HNO_3 sp. gr. $1{\cdot}42+1$ part water), till the limestone, if present, is completely decomposed. The mixture after treatment with acid is transferred to the 250 cc. beaker containing the suspension of clay and fine sand. The acid coagulates the clay in suspension and the sand, clay, organic debris and humus settle down in the beaker.

The contents of the beaker are filtered and the residue is freed from nitric acid and lime salts by washing it with distilled water till the residue again shows sign of going into suspension.

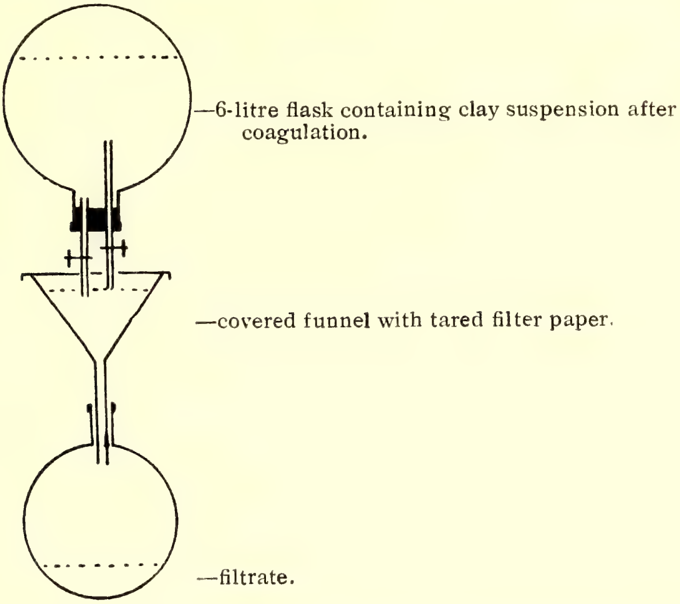
The residue is transferred to a beaker of about 2 litres capacity using distilled water. 1 cc. of ammonia (sp. gr. 0·88) and 1000 cc. of distilled water are added. The mixture is stirred and allowed to stand for 24 hours. By this operation sand and organic debris settle down, humus goes in solution, while clay remains in suspension. After standing for 24 hours, the supernatant liquid is carefully syphoned off and collected in a 6 litre flask. After syphoning 1 cc. of ammonia and 1,000 cc. of water are again added to the sediment in the beaker, the mixture stirred and after 24 hours' standing, the supernatant liquid is decanted and added to that previously collected. In all, three such operations are sufficient to remove all clay. If necessary these are repeated, the end point being judged by the more or less turbid aspect of the liquid.

The residue of sand and organic debris remaining behind in the 2 litre beaker is dried on a water bath, transferred to a large porcelain crucible and dried to constant weight at 100°C. The residue is then ignited, till the organic matter is completely oxidised and the crucible is weighed. From the weights the percentages of sand and organic debris are calculated.

To the turbid liquid in the 6 litre flask, saturated solution of potassium chloride is added (10 cc. of saturated KCl per 1000 cc. of the turbid liquid). The clay coagulates and settles, while humus remains in solution. The mixture is filtered and the clay is collected on a weighed filter paper. The filter paper with clay is dried to constant weight at 100°C. From the weights the percentage of colloidal clay is calculated.

To the filtrate containing humus in solution hydrochloric acid is added (5 cc. of HCl sp. gr. 1·16 per 1,000 cc. of the filtrate). Humus is precipitated as a brownish black mass. The mixture is filtered and the humus is collected on a weighed filter paper. The filter paper with humus is dried to constant weight at 100°C. From the weights the percentage of humus is calculated.

In the above procedure the weighed filter paper is prepared by washing a 15 cm. filter paper with 4,000 cc. of distilled water and drying it to constant weight at 100°C. For the filtration of clay and humus the following arrangement is used.


—6-litre flask containing clay suspension after coagulation.
—covered funnel with tared filter paper.
—filtrate.

The above is self explanatory and facilitates filtration of clay which usually requires from two to three days.

Results :—

NOTE.—Although fine earth is used in the above mechanical analysis, the results of analysis are always expressed with reference to the normal earth and not with reference to fine earth.

Weight of watch glass + fine earth = 25·4642 grams.
Weight of watch glass = 14·2428 grams.

Weight of fine earth used = 11·2214 grams.

Sand and organic debris

Weight of crucible + sand + organic debris = 67·4596 grams.
Weight of crucible = 56·7922 grams.

Weight of sand and organic debris = 10·6674 grams.
Weight of crucible + sand (after heating) = 67·0092 grams.
Weight of sand = 10·2170 grams.
Weight of organic debris = 10·6674 – 10·2170
= 0·4504 grams.

Hence percentage of sand = $\frac{10{\cdot}217 \times 88{\cdot}563}{11{\cdot}2214} = 80{\cdot}63$,

and percentage of organic debris = $\frac{0{\cdot}4504 \times 88{\cdot}563}{11{\cdot}2214} = 3{\cdot}56$

Clay

Weight of filter paper + clay = 4·3986 grams.
Weight of filter paper = 4·0880 grams.

Weight of clay = 0·3106 grams.
Hence percentage of clay $= \frac{0{\cdot}3106 \times 88{\cdot}563}{11{\cdot}2214} = 2{\cdot}45.$

Humus

Weight of filter paper + humus = 4·2592 grams.
Weight of filter paper = 4·2092 grams.

Weight of humus = 0·0500 grams.
Hence percentage of humus $= \frac{0{\cdot}05 \times 88{\cdot}563}{11{\cdot}2214} = 0{\cdot}40.$

C. *Chemical analysis.*

1. *Preparation of nitric acid solution.*

50 grams of the fine earth are weighed out in a 750 cc. conical flask. The earth is moistened with water, and nitric acid (sp. gr. 1·42) is added, drop by drop, till the carbonates, if at all present, are decomposed. When the decomposition is effected, 75 cc. of nitric acid (sp. gr. 1·42) are added and the flask, covered with a funnel, is heated on a water bath, with occasional shaking, for 24 hours.

At the end of 24 hours, the liquid in the conical flask is diluted with 30 cc. of water and decanted through a filter. The insoluble residue is washed by decantation with hot water containing 5 cc. of nitric acid (sp. gr. 1·42) per litre, till the filtrate gives no yellow colour due to iron. When the washing is complete, the residue is transferred to the filter and kept aside.

The filtrate is evaporated in a dish on a sand bath and the residue is dehydrated on a water bath for two hours. After dehydration, add 5 cc. of nitric acid (sp. gr. 1·42) and 100 cc. of hot water. Boil and filter. Wash the insoluble residue with hot water containing nitric acid as before, and collect and keep aside the insoluble residue of silica, on a separate filter paper.

The filtrate, in the above operation, is subjected to a second evaporation in a similar manner in order to remove the last traces of silica from solution.

The filtrate, from which silica has been removed is cooled and made upto 500 cc. *This nitric acid solution is used in the chemical analysis, when required.*

The main portion of the earth, together with the two silica residues from the two evaporations are transferred to a nickel dish. The dish is heated at first on a small flame to burn off papers and then the residue is ignited at full blast to constant weight.

Results :—

(Cf. Note under Results of mechanical analysis, p. 367.) Chemical analysis.

Weight of beaker + fine earth = 151·7888 grams.
Weight of beaker = 103·5260 grams.

Weight of fine earth used in chemical analysis = 48·2627 grams.

Main portion insoluble in HNO_3

Weight of nickel dish + residue + + filter ash (3 papers) = 91·2870 grams.
Weight of nickel dish = 49·5628 grams.
Weight of filter ash from 3 papers = 0·0282 grams.

49·5910 grams.
∴ Weight of residue = 41·6960 grams.

Hence percentage of main portion insoluble in HNO_3 $= \frac{41·696 \times 88·563}{48·263} = 76·514$

N.B.—The result ' of main portion insoluble in nitric acid ' is not reported under ' insoluble in nitric acid '. For calculating ' insoluble in nitric acid, see calculations and remarks p. 375.

2. *Estimation of Aluminium and Iron.*

50 cc. of the nitric acid solution are treated in a porcelain dish with 5 N sodium hydroxide solution until strongly alkaline, boiled, diluted with 100 cc. of hot water, and filtered. The precipitate contains the iron as hydroxide, while the filtrate contains the aluminium as aluminate. The precipitate is dissolved in hot 5 N hydrochloric acid and the iron is reprecipitated as hydroxide with sodium hydroxide. The precipitate of iron hydroxide is freed from chlorides by washing with hot 2 per cent ammonium nitrate solution and the two filtrates containing the aluminium as aluminate are combined together.

The filtrate containing the aluminium is acidified with 5 N nitric acid. 20 cc. of 20 per cent ammonium nitrate, one macerated filter paper and a few drops of methyl red (0·2 per cent alcoholic solution) are added. The mixture is heated to 66°C and 5 N ammonium hydroxide is added till alkaline. The precipitate is filtered, washed with hot 2 per cent ammonium nitrate solution, ignited wet and weighed as alumina (Al_2O_3). By adopting this procedure filtration of the precipitate and final ignition to a fine powder are rendered easy.

The precipitate of iron hydroxide is dissolved in hot 5 N sulprhuric acid in a 500 cc. Erlenmeyer flask. The solution is boiled and hydrogen sulphide is passed till all the iron is reduced. When the reduction is complete, the mixture is boiled to expel the sulphuretted hydrogen, cooled while passing a current of carbon dioxide and titrated against standard potassium permanganate solution.

Results :—

50 cc. of the nitric acid solution are used.

Aluminium

Weight of crucible + Al_2O_3 + ash = 26·8912 grams.
Weight of crucible = 26·8248 grams.
Weight of filter ash = 0·0094 grams.
Weight of ash of macerated filter = 0·0023 grams.

26·8365 grams.
∴ Weight of Al_2O_3 = 0·0547 grams.
Hence percentage of Al_2O_3 $= 0·0547 \times 10 \times \frac{88·563}{48·263}$
= 1·004.

Iron

The solution after reduction required $27{\cdot}8$ cc. of $0{\cdot}09752$ N $KMnO_4$

$= (27{\cdot}8 \times 0{\cdot}09752)$ cc. $\frac{N}{1}$ $KMnO_4$.

1 cc. $\frac{N}{1}$ $KMnO_4$ $=$ $0{\cdot}07984$ gram Fe_2O_3.

Hence percentage of Fe_2O_3 $= (27{\cdot}8 \times 0{\cdot}09752) \times 10 \times 0{\cdot}07984 \times \times \frac{88{\cdot}563}{48{\cdot}263}$

$= 3{\cdot}972.$

3. *Estimation of 'Combined Oxides' and Phosphorus.*

50 cc. of the nitric acid solution are transferred to a 500 cc. beaker. 20 cc. of 20 per cent ammonium nitrate and a few drops of methyl red (0·2 per cent alcoholic solution) are added. The mixture is heated to 66°C and 5 N ammonium hydroxide is added till alkaline. The precipitate contains the hydroxides of the trivalent metals, while calcium and magnesium remain in solution. The precipitate is redissolved in hot 5 N hydrochloric acid, one macerated filter paper is added and the trivalent metals are reprecipitated with ammonia as before. The precipitate is thoroughly washed with hot 2 per cent ammonium nitrate solution and the two filtrates containing calcium and magnesium are combined together and kept aside for their estimations.

The precipitate is ignited wet and weighed as 'combined oxides'.

The precipitate of 'combined oxides' is fused with six times its weight of a mixture consisting of four parts of anhydrous sodium carbonate and one part of pure silica. The mixture is fused, the melt is extracted with 1 per cent ammonium carbonate solution and filtered. The filtrate contains all of the phosphoric acid and a very little silicic acid. The filtrate is acidified with 5 N hydrochloric acid, evaporated to dryness on a water bath, and the residue is moistened with a few drops of 5 N hydrochloric acid. The mass is dehydrated on the water bath for two hours and then extracted with 100 cc. of hot water. The mixture is filtered and the slight residue of silica is washed with hot water. The filtrate now contains all of the phosphoric acid.

The filtrate is concentrated to about 50 cc., 5 cc. of 5 N hydrochloric acid, 20 cc. of 'magnesia mixture' (55 grams $MgCl_2 . 6 H_2O$ are dissolved in 650 cc. water, adding 105 grams of ammonium chloride, and made up to 1,000 cc.) and 10 cc. of 2 N ammonium chloride are added. The mixture is boiled and 5 N ammonium hydroxide solution is added drop by drop, slowly so as to obtain a crystalline precipitate, the dropwise addition of ammonia being continued till the mixture is alkaline: one-third the solution's volume of 5 N ammonium hydroxide is then added and the mixture is allowed to stand for four hours. The precipitate of magnesium ammonium phosphate is filtered, washed with 2·5 per cent ammonia to remove chlorides, dried, ignited separately from the filter paper and weighed as magnesium pyrophosphate, $Mg_2P_2O_7$.

Results :—

'*Combined oxides*' i.e. ($Al_2O_3 + Fe_2O_3 + P_2O_5 + Mn_3O_4$, etc.) 50 cc. of nitric acid solution are used.

Weight of crucible + oxides + ash = 26·0688 grams.
Weight of crucible = 25·6800 grams.
Weight of filter ash = 0·0094 grams.
Weight of ash from macerated filter paper = 0·0094 grams.

25·6988 grams.

∴ Weight of combined oxides = 0·3700 grams.
Hence percentage of combined oxides = $0{\cdot}3700 \times 10 \times \frac{88{\cdot}563}{48{\cdot}263}$
= 6·790.

NOTE.—(The percentage of combined oxides is not reported in the final results. Its value is used as a check on Al_2O_3, Fe_2O_3, P_2O_5, and Mn values determined separately. The 'combined oxides' value is *slightly* greater than the sum of oxides due to Al, Fe, P, and Mn, indicating presence of traces of titanium and other trivalent metals. As these are considered of no value for the investigation of mineral metabolism in animals, they are not determined.)

P_2O_5.

Weight of crucible + $Mg_2P_2O_7$ + ash = 25·8271 grams.
Weight of crucible = 25·6802 grams.
Weight of ash = 0·0094 grams.

25·6896 grams.

∴ Weight of $Mg_2P_2O_7$ = 0·1375 grams.
But 1 gram $Mg_2P_2O_7$ = 0·6379 gram P_2O_5.
Hence percentage of P_2O_5 = $0{\cdot}1375 \times 10 \times 0{\cdot}6379 \times \frac{88{\cdot}563}{48{\cdot}263}$
= 1·610.

4. *Estimation of Calcium and Magnesium.*

The filtrate obtained in the estimation of 'combined oxides' and containing calcium and magnesium is evaporated to about 100 cc. 5 cc. of 5 N hydrochloric acid and 20 cc. of a saturated ammonium oxalate solution are added. The mixture is boiled. 5 N ammonium hydroxide solution is added drop by drop till alkaline and the mixture is heated on a water bath for one hour. The solution is filtered. To the filtrate are added 5 cc. of saturated ammonium oxalate and 5 N ammonium hydroxide till alkaline. The filtrate is reheated on the water bath for 15 minutes to ascertain quantitative precipitation of calcium as oxalate. At this stage, the clear filtrate contains magnesium.

The precipitate of calcium oxalate is dissolved in hot 5 N hydrochloric acid. Dilute the solution to 100 cc.; add 2 cc. of saturated ammonium oxalate and make the solution alkaline by adding 5 N ammonium hydroxide. Digest on the water bath as in the first precipitation and filter. Wash the precipitate of calcium oxalate with hot water, adding one drop of ammonium oxalate solution each time the funnel is filled. The filtrate in the second precipitation is combined with the previous filtrate containing magnesium.

The calcium oxalate precipitate is dissolved in cold 2 N sulphuric acid. 50 cc. of 2 N sulphuric acid are then added. The mixture is warmed and titrated against standard potassium permanganate.

Estimation of Magnesium.

To the filtrate, after separation of calcium, add 25 cc. of nitric acid (sp. gr. 1·42) and evaporate to 50 cc. Nitric acid removes excess of ammonium salts and thus renders concentration of the solution possible without crystallisation when cooled. To the concentrated solution add 50 cc. of 5 N hydrochloric acid and then 5 N ammonium hydroxide till alkaline. If a precipitate of magnesium hydroxide forms, repeat the addition of hydrochloric acid and ammonia until the solution can be made alkaline without the formation of a precipitate. Next make the solution acidic to methyl orange with 5 N hydrochloric acid. To the acidic solution add 10 cc. of 2 N ammonium chloride and 20 cc. of 10 per cent ammonium phosphate. At this stage the solution should be sufficiently acidic to prevent the formation of a permanent precipitate on adding the phosphate solution. The mixture is boiled. 5 N ammonium hydroxide is added drop by drop till alkaline and one-third the solution's volume of 5 N ammonium hydroxide is added and the mixture is allowed to stand for four hours. The precipitate is filtered and the filtrate is subjected to a second precipitation as before, to ensure that all the magnesium is quantitatively precipitated. The precipitate of magnesium ammonium phosphate is washed with 2·5 per cent ammonium hydroxide to remove chlorides, dried, ignited separately from the filter paper and weighed as magnesium pyrophosphate.

Results :—

50 cc. of nitric acid solution are used.
The solution of calcium oxalate in sulphuric acid required 9·1 cc. of 0·09752 N $KMnO_4$.
$= (9{\cdot}1 \times 0{\cdot}09752)$ cc. $\frac{N}{1}$ $KMnO_4$.

1 cc. of $\frac{N}{1}$ $KMnO_4$ = 0·02804 gram CaO.
Hence percentage of CaO $= (9{\cdot}1 \times 0{\cdot}09752) \times 10 \times 0{\cdot}02804 \times \frac{88{\cdot}563}{48{\cdot}263}$
$= 0{\cdot}457.$

Magnesium :—

Weight of crucible + $Mg_2P_2O_7$ + ash = 26·6474 grams.
Weight of crucible = 26·5308 grams.
Weight of ash = 0·0044 grams.

26·5852 grams.

∴ Weight of $Mg_2P_2O_7$ = 0·0622 grams.
But 1 gram $Mg_2P_2O_7$ = 0·3621 gram MgO.
Hence percentage of MgO $= 0{\cdot}0622 \times 10 \times 0{\cdot}3621 \times \frac{88{\cdot}563}{48{\cdot}263}$
$= 0{\cdot}413.$

5. *Estimation of total Potash and total Soda present in the salt-lick or earth.*

0·5 gram of the fine earth is decomposed by the fusion method of J. Lawrence Smith. Potassium is estimated by precipitation as potassium perchlorate, while sodium is determined by difference.

Results :—

Weight of weighing bottle + fine earth = 36·5906 grams.
Weight of weighing bottle = 36·0844 grams.

∴ Weight of fine earth used = 0·5062 grams.
Weight of dish + $(KCl + NaCl)$ + + insoluble residue = 37·3542 grams.

The alkali salts are dissolved in water and filtered. The dish is dried and weighed. The filter containing the insoluble residue is incinerated.

Weight of empty dish = 37·3292 grams.
Weight of crucible + ash of filter + + insoluble residue = 26·8274 grams.
Weight of crucible = 26·8228 grams.
Weight of ash = 0·0044 grams

26·8272 grams.
∴ Weight of insoluble residue = 26·8274 – 26·8272
= 0·0002 grams.
Hence weight of $(KCl + NaCl)$ = 37·3542 – 37.3292 – 0·0002
= 0·0248 grams.
Hence percentage of $(KCl + NaCl)$ = $0{\cdot}0250 \times \frac{88{\cdot}563}{0{\cdot}5062}$
= 4·374.
Weight of Gooch crucible + $KClO_4$ = 13·5056 grams.
Weight of Gooch crucible = 13·4592 grams.

∴ Weight of $KClO_4$ = 0·0464 grams.
But 1 gram of $KClO_4$ = 0·5381 gram KCl.
∴ percentage of KCl = $0{\cdot}0464 \times 0{\cdot}5381 \times \frac{88{\cdot}563}{0{\cdot}5062}$
= 4·368.
and percentage of $NaCl$ = 4·374 – 4·368
= 0·006 grams.
But 1 gram KCl = 0·6317 gram K_2O
and 1 gram $NaCl$ = 0·5303 gram Na_2O.
∴ percentage of K_2O = 4·368 × 0·6317 = 2·760
and percentage of Na_2O = 0·006 × 0·5303 = 0·003.

6. *Estimation of Manganese.*

Transfer 5 cc. of nitric acid solution to a beaker, add 25 cc. of nitric acid (1 part HNO_3 sp. gr. 1·42 + 3 parts water) and about 0·5 gram sodium bismuthate. Heat until the permanganate colour disappears. Add a few drops of 10 per cent sodium bisulphite solution to clear the solution and again boil to expel oxides of nitrogen. Cool to room temperature, again add about 0·5 gram sodium bismuthate and stir. When the maximum permanganate colour is developed, filter through a Gooch crucible containing an asbestos mat that has been ignited, treated with 4 per cent potassium permanganate, and washed with water. Wash the precipitate with dilute sulphuric acid (25 cc. of H_2SO_4 sp. gr. 1·84 diluted to 1 litre, a few drops of N/10 $KMnO_4$ being added to colour the dilute acid *faintly*) until the washings are colourless. The filtrate is transferred to a 100 cc. Nessler tube and diluted to 100 cc. with the above mentioned dilute sulphuric acid. The colour of this solution is matched with a standard solution of potassium permanganate prepared by diluting 0·2, 0·3, 0·4 cc. etc. of standard permanganate in another Nessler tube, to 100 cc. with dilute sulphuric acid. The standard potassium permanganate is prepared by dissolving 0·2877 gram $KMnO_4$ in distilled water and diluting to 1 litre.

Results :—

1 cc. of standard $KMnO_4$ = 0·0001 gram Mn.

The colour of 5 cc. of nitric acid solution after bismuthate treatment and dilution to 100 cc. was matched with 1·6 cc. of standard $KMnO_4$ diluted to 100 cc.

Hence percentage of Mn

$$= 1{\cdot}6 \times \frac{500}{5} \times 0{\cdot}0001 \times \frac{88{\cdot}563}{48{\cdot}263} = 0{\cdot}147.$$

7. *Estimation of Sulphur.*

50 cc. of nitric acid solution are transferred to a 250 cc. beaker, 5 cc. of 5 N hydrochloric acid are added, and the mixture is boiled. To the boiling solution 10 cc. of 20 per cent barium nitrate solution are added, and the mixture allowed to stand at room temperature for 12 hours. The precipitate of barium sulphate is filtered, washed with hot water to remove chloride, dried, ignited and weighed as barium sulphate.

8. *Estimation of total 'Acid and Water soluble' Chlorine.*

10 grams of fine earth are weighed out in a 250 cc. conical flask. Dilute nitric acid (1 part HNO_3 sp. gr. 1·49 + 40 parts water) is added till the limestone, if present, is completely decomposed, when 100 cc. of dilute nitric acid are added. The mixture is heated on a water bath for one hour. The mixture is filtered and the residue is washed with hot water. The filtrate is rendered alkaline with $\frac{N}{1}$ sodium carbonate and allowed to stand for half an hour. The mixture is filtered and the residue washed with hot water. The filtrate is evaporated to 50 cc., faintly acidified with acetic acid, and titrated against standard silver nitrate using 5 drops of 1 per cent potassium chromate as the indicator.

9. *Estimation of Soluble Silica.*

About 2 grams of fine earth are weighed out in a porcelain dish and a mixture of 100 cc. of water and 50 cc. of sulphuric acid (sp. gr. 1·84) is added. The dish is covered with an inverted funnel and heated over an asbestos wire gauze until dense fumes of sulphuric acid vapours are evolved. The contents of the dish are allowed to cool, 150 cc. of water and 3 cc. of hydrochloric acid (sp. gr. 1·16) are added. The mixture is boiled, with constant stirring for 15 minutes, filtered and the residue washed with hot water until free from sulphate. After washing the residue is digested with 100 cc. of 5 per cent sodium carbonate on a water bath for 15 minutes and filtered. (The filtrate is tested for unchanged carbonate, otherwise the residue is digested a second time with 5 per cent sodium carbonate.) The residue, after digestion, is washed twice with 5 per cent sodium carbonate solution and then with hot water until free from carbonate. If the filtrate is turbid, a little alcohol is added, after which the filtrate will run through clear.

The alkaline filtrate contains soluble silica. It is acidified with hydrochloric acid (sp. gr. 1·16) and evaporated to dryness. The residue is dehydrated at first on a water bath for one hour and then at 110°C for two hours. The residue is digested with 100 cc. of hot water and the mixture filtered. The residue is washed with hot water until free from chloride, dried, ignited and weighed.

Results :—

Weight of weighing bottle + fine earth = 38·9698 grams.
Weight of weighing bottle = 36·5906 ,,

∴ Weight of fine earth used = 2·3792
Weight of crucible + silica + ash = 25·0314 grams.
Weight of crucible = 24·7462 grams.
Weight of ash = 0·0094 ,,

24·7556

∴ Weight of silica = 0·2758 gram.

Hence percentage of soluble silica = $\frac{0\cdot2758 \times 88\cdot563}{2\cdot3792} = 10\cdot267$.

10. *Estimation of Moisture and Organic Matter in Fine Earth.*

About 2·5 to 3·5 grams of the fine earth are ignited to constant weight in a crucible.

Results :

Weight of fine earth used = 3·3396 grams.
Weight of crucible + fine earth before heating = 60·1317 grams.
Weight of crucible + fine earth after heating = 59·9662 ,,

∴ Weight of moisture and organic matter = 0·1655 ,,

Hence percentage of moisture and organic matter = $\frac{0\cdot1655 \times 88\cdot563}{3\cdot3396} = 4\cdot389$.

11. *Estimation of Carbon Dioxide.*

Carbon dioxide is estimated by the Schrotter apparatus using about 2 grams of fine earth.

12. *Estimation of 'Insoluble in Nitric Acid'.*

The 'insoluble in nitric acid' is calculated from analytical data determined separately:—

The analytical data for the earth as analysed by the above method are as follows:—

'Main portion insoluble in HNO_3' = 76·514 per cent.
Soluble SiO_2 = 10·267 ,,

Total K_2O = 2·760 per cent.
Total Na_2O = 0·003 ,,
Cl (water and acid soluble) = nil.

To calculate 'insoluble in HNO_3' add total Na_2O and K_2O, and from the sum subtract Na_2O equivalent to chlorine.

$$2·760 + 0·003 = 2·763 - 0 = 2.763.$$

Add this value to soluble silica and subtract the value obtained from main portion insoluble in nitric acid

$$2·763 + 10·267 = 13·030$$
$$\text{and } 76·514 - 13·030 = 63·484.$$

The value 63·84 percent is reported as 'insoluble in nitric acid' and evidently represents all the constituents, except sodium and potassium, insoluble in nitric acid that have not been determined. The value represents *chiefly sand* mixed with *slight traces of minerals undecomposed by* nitric acid.

D. *Analysis of Water soluble Substances present in the Salt-lick or Earth.*

1. *Estimation of Water soluble Organic and total Inorganic Matter.*

100 grams of the soil (not fine earth) are weighed out in a 500 cc. conical flask, and 250 cc. of water are added. The flask is stoppered, shaken thoroughly and allowed to stand for 24 hours. After 24 hours the mixture is filtered. 50 cc. of the filtrate are evaporated, the residue is dried to constant weight at 100°C in a steam oven. The residue is ignited at *a low red heat* to drive off organic matter, cooled and weighed for total inorganic solids.

Results :

Weight of soil used = 104·4350 grams.

After extraction with 250 cc. of water, 50 cc. of the filtrate gave the following results:

Weight of dish + residue = 60·2208 grams.
Weight of dish = 60·1411 ,,
Weight of dish + inorganic matter in the residue = 60·1988 grams.
∴ Weight of organic matter = 60·2208 − 60·1988 = 0·0220 grams,
and weight of inorganic matter = 60·1988 − 60·1411 = 0·0577 ,,

Hence percentage of total water-soluble organic matter

$$= 0·0220 \times 5 \times \frac{100}{104·44} = 0·105,$$

and percentage of total water-soluble inorganic matter

$$= 0·0577 \times 5 \times \frac{100}{104·44} = 0·2763$$
$$= 0·276.$$

2. *Estimation of Colloidal Silica and Inorganic Matter (other than alkali chloride, alkali carbonate and gypsum).*

The residue, remaining in the dish after removing organic matter, is extracted with small quantities (10 cc.) of hot water. The filtrate allowed to cool and made up to 100 cc. The insoluble residue, on the filter paper, is dried, ignited in a crucible and weighed for silica and inorganic matter.

Results :—

Weight of crucible + residue + ash = 26·8892 grams.
Weight of crucible = 26·8228 ,,
Weight of ash = 0·0094 ,,

26·8322 ,,
∴ Weight of residue = 0·0570 ,,
Hence percentage of colloidal silica and other inorganic matter

$$= 0\cdot0570 \times 5 \times \frac{100}{104\cdot44} = 0\cdot2728.$$

3. *Estimation of Water soluble Alkali Carbonate.*

25 cc. of the filtrate obtained in (2) are titrated against 0·1 N hydrochloric acid using methyl orange as an indicator. From the titre reading the result is calculated and reported as percentage of sodium carbonate.

4. *Estimation of Water soluble Alkali Chloride.*

25 cc. of the filtrate obtained in (2) are titrated against 0·1 N silver nitrate using 5 drops of 1 per cent potassium chromate as an indicator or 25 cc. of the filtrate are acidified with dilute nitric acid (1 part HNO_3 sp. gr. 1·42 + 4 parts water) and chlorine is precipitated and weighed as silver chloride. The result is reported as percentage of NaCl.

Results :

Weight of Gooch crucible + AgCl = 13·4638 grams.
Weight of Gooch crucible = 13·4634 ,,
∴ Weight of AgCl = 0·0004 gram.
1 gram AgCl = 0·4078 gram NaCl.

Hence percentage of NaCl $= (0\cdot0004 \times 4) \times 5 \times 0\cdot4078 \times \frac{100}{104\cdot44} = 0\cdot0031.$

5. *Estimation of Gypsum.*

The gypsum content is calculated by difference as follows:—

Total water-soluble inorganic matter = 0·2763 per cent.

The sum of percentages of colloidal silica etc., alkali carbonate, and alkali chloride is :

0·2728 + 0 + 0·0031 = 0·2759.
Hence percentage of gypsum = 0·2763 − 0·2759
= 0·0004.
i.e. gypsum is present in traces.

The results are reported as above under Analysis XXXIX.

(*To be continued*).

REVIEWS.

I. THE BIRDS OF NIPPON, Vol. I, Part 5. By Prince Taka-Tsukasa. H. F. & G. Witherby, London.

There are at present available to English readers only two books on the Birds of Japan, the earlier by Temminck and Schlegel (1845-1850) and the latter by Seebohm (1890) and both these are out of print and difficult to procure. A more recent work by Dr. Uchida was unfortunately for the cause of international science written in Japanese and has not been available to western ornithologists.

There is every reason, therefore, to welcome the appearance of a beautifully produced book in English on the birds of Japan by Prince Taka-Tsukasa, the president of the Ornithological Society of Japan. This work will be completed in five volumes. It will deal with bird-life in all the Japanese possessions from Sakhalin and the Kurile Islands in the north down to Formosa and the Loo-Choo Islands in the south, from Korea in the west to the Bonin Islands in the east, and in addition the various groups of Japanese mandatory islands. Its scope is therefore defined in the political rather than in the strictly zoo-geographical sense. Every species in this Japanese Empire is to be figured in colour together with the eggs and chicks of all breeding species. Distributional maps and phtogravure plates of nests and types of country will further embellish a text which is to be on the most complete scale.

We have hitherto received the first four parts which deal with the introduction, physiography and the history of Japanese ornithology in addition to instalments of the main text. This starts with the order *Galli* and so far treats of the Megapode, various pheasants and the Japanese Quail, the last of these being the only species included in the Indian list. The account of each species is very complete. It starts with the transcription in full of the original description with which the scientific name was published, a useful feature too long for inclusion in ordinary books. It continues with a synonymy and list of principal references, the principal vernacular names in different languages, and the usual descriptions of plumage and measurements. The distribution, the nidification and a long account of habits follow and the account ends with various notes including the history of the species in captivity.

In these accounts we must be grateful to Prince Taka-Tsukasa for his industry in collecting a wealth of information both from published and unpublished sources. But unfortunately this material has not always been handled with sufficient discretion. Its very wealth defeats its own object for the sections often become long and straggling and hard to comprehend. A little compression, some omissions of redundant material and more clearness of summary would all have been to the good.

The preliminary discussion of the limits of the genus *Syrmaticus*, for instance, occupies eighteen pages before the author approaches the account of the pheasants included in it. It is difficult to follow. The train of thought is far from consecutive and at the end the reader is left with the impression that these eighteen pages should have been treated as the preliminary notes from which the author wrote his final account and decision.

There are other points to which criticism might be directed but these may be well disregarded in appreciation of the fact that Prince Taka-Tsukasa is giving ornithologists a most beautiful book. The cost of production will be very heavy and the author cannot expect to see any return from his expenditure as the edition is limited to 250 copies.

H. W.

II. NATURAL HISTORY OF CENTRAL ASIA, vol. x. 'THE REPTILES OF CHINA'. By Clifford H. Pope. Pp. xlvii+604, 77 text-figures, 27 plates and 1 map. The American Museum of Natural History, New York, May 11, 1935. Price $ 10.

From over one hundred papers that have appeared on different groups of animals, zoologists are already familiar with the wealth of material obtained and the valuable biological and ecological data collected by the members of 'The Central Asiatic Expeditions' of the American Museum of Natural History. The Expedition explored the natural history of Mongolia and China in the years 1921-1930. Field work was conducted in Mongolia during the summers and in China during the winter months.

The final reports of the Expedition embrace a series of 12 quarto volumes. Of these the volumes dealing with 'The New Conquest of Central Asia' (vol. i), 'The Geology of Mongolia' (vol. ii) and 'The Permean of Mongolia' (vol. iv) appeared some years ago, while the tenth volume of the series reviewed here has appeared only recently.

The Reptiles of China (Turtles, Crocodilians, Snakes, Lizards) are treated in five parts in the work under review. Part I comprising the general introduction deals with the collecting of the material in different Provinces and the methods followed in describing the species. The second part, which deals with the systematic account of the species and subspecies of Chelonians, Crocodilians and Snakes, is very comprehensive. It includes the synonymy, description, distribution, habits, habitats and the material examined of each species. Remarks are also made, wherever possible, on details not included in the above descriptive headings. In the third part a resumé of the natural history of Chinese snakes is given and attention is directed to their ecology, sexual characters and maxillary teeth. Lists of species and subspecies of snakes by Provinces is also included in this part. Part IV deals with lizards and includes an annotated check list of the species in which information is recorded as to the type-locality, distribution and material examined of each species. The final part comprises appendices, such as maps, list of localties, bibliography, index, etc.

The special feature of this work lies in the fact that the author himself worked in the field so that he imparts to his readers a first-hand knowledge of the natural history of the animals with which he deals. The work is of a monographic nature, as it presents a systematic study not only of the reptiles collected by the author himself but also of the Chinese reptiles in the larger museums throughout the world. Pope's excellent monograph is absolutely indispensable to the students of Chinese and Oriental herpetology. The treatment of the subject is admirable, the figures are neat and clear, and the get-up is all that could be desired. Mr. Pope deserves to be congratulated on the production of such a magnificent piece of work. He has indeed laid all herpetologists under a deep debt of gratitude.

S. L. H.

III. AUF STILLEN PFADEN (GUJA). By WALTER VON SANDEN. 9¼ in. × 6¼ in. 123 pp., 104 photos in the text. Gräfe und Unzer Verlag, Koenigsburg (Prussia), 1935. Price RM. 4.80.

This book describes a cycle of the seasons as expressed in the natural history —principally bird-life—of a lake (Guja) in East Prussia. This is perhaps its chief interest to us in India. For though somewhat parochial in its scope it affords an example of what may be achieved in the way of pleasantly written and well-illustrated popular natural history books dealing with sections of our own country. It is the author's second book on the self-same locality and he rightly observes that it is not necessary to travel to distant lands in search of Nature; that a small portion of one's own homeland may easily provide opportunities and subjects for lifelong study and that although countries and environments may vary and Nature also appear in different garbs, yet the underlying truths of Nature are everywhere and always the same.

The author deals in a pleasant, but unfortunately sometimes rather too superficial, way with the lives and nesting habits of the Marsh Harrier (a winter visitor to India), the Bittern, the Coot and various other birds and mammals inhabiting the lake and its vicinity. Marsh Harriers are said to be very destructive to the eggs and young of other birds. Eggs of bitterns and young of black-throated divers and coots are amongst the worst sufferers at their hands. A brood of six young magpies was lifted by them, whilst two young harriers which died in the nest are also suspected to have been devoured by the family. A full clutch consists of 4 or 5 eggs—rarely 6. Incubation is done solely by the female. The nest in time becomes a filthy accumulation of excrements of the young and the remains of food brought in by the parents. The young leave the nest about two months after hatching.

Coots, says the author, are unloved and persecuted by hunters due to insufficient knowledge of their life-history. They are falsely stigmatised as being quarrelsome and thereby as driving away ducks from waters inhabited by themselves. As a matter of fact what really conduces to the diminution in the numbers of duck is the coot-hunts organised in their protection which result in frightening away all breeding birds from the lake. The best and most effective way of controlling coots would be to remove their eggs unostentatiously thus leaving the duck and other birds undisturbed.

The Bittern is said to 'boom' five times in succession, seldom more, when at the height of his courtship display. From his experience the author concludes that the Bittern is polygamous and that the male does not assist in the construction of the nest or in the incubation of the eggs. He thinks that many of the nests robbed by terrestrial animals such as foxes and weasels are located by them through following the footprints of human beings who have visited the nests before.

Crabs are said to be very sedentary and long lived. The author recognised one particular individual which he captured on the same spot thrice in two years.

One or two addled eggs are frequently found left behind in swans' nests which are so charged with foul gases as to explode like a hand-grenade on the slightest attempt to blow them!

A strong plea is made for the camera over the gun in the pursuit of nature study, but the author admits that he could never have secured the best of his photographs without the experience and cunning previously acquired as a hunter. Some of his photos, especially those of the nesting harriers and bitterns, are very good and the general format of the book is pleasing. We think it a pity that scientific names should have been so rigidly avoided throughout and only the German ones given; those unfamiliar with the latter are apt to be left in some doubt as to the exact species under reference.

S. A. A.

IV. A FLOWER BOOK FOR THE POCKET. By MACGREGOR SKENE; 380 pp.; 501 illustrations in colour, 28 in black and white; 12 text-figs. Oxford University Press, London: Humphrey Milford (1935). Price 7*s*. 6*d*. net.

Instances are not wanting of protests made by authors against uncalled for criticism on the plea of an erroneous view of the end and aim they had set before them. In the present case such a misrepresentation is not likely to occur for in a prefatory note entitled *How to use this book* Professor Macgregor Skene clearly states for whom the book is meant, and what service it will likely render them.

It is a book for beginners, and it opens with an explanation of the time-honoured classification of plants according to species, genera, and families, and with a useful survey of botanical terms and characters. This is followed by keys to all the British families (pp. 18-26), and all the important British genera (pp. 27-95). Then come descriptions of 844 species of British Wild Flowers according to families (pp. 98-366), and the book closes with a long list of names arranged alphabetically by way of index.

The book is excellent in every respect.

On account of its very excellence it is to be regretted that the author should have come to grief over a matter of minor importance; one, in fact, which might have been omitted without appreciably detracting from the value of the book. The transliteration of Greek names is uncertain—e.g., *ipsilon* appears as *i*, *u*, *y*—, and their derivation faulty—v.g., the *t* in ANTIRRHINUM is not *thita* but *taf.*

J. F. C.

MISCELLANEOUS NOTES.

I.—THE LION IN BALUCHISTAN.

For many years it has been feared that the last of the Asiatic lions are those preserved in the Gir Forest. But in the *Field*, June 8, 1935, p. 1421, there is a record of one being recently observed near the Bolan Pass, south of Quetta in Baluchistan. The animal was seen at close quarters from a train by Admiral Philip Dumas, his wife and another lady. Since no other animal occurs in the country that could be mistaken for a lion, there is no reason to doubt the authenticity of the record. Admiral Dumas's letter was submitted to me for my opinion and published on my recommendation. The footnote to it, signed by the editor, embodies my reasons for believing there can be no doubt about the truth of the fact recorded, which will interest all Indian sportsmen and naturalists and is worth recording in a journal of higher standing than the paper in which it first appeared.

ZOOLOGICAL DEPARTMENT OF THE
BRITISH MUSEUM (NAT. HIST.),
LONDON.
June 12, 1935.

R. I. POCOCK, F.R.S.

[We print below Admiral Dumas's letter to the *Field* dated 8th June 1935 and a summary of the correspondence which appeared in the London *Times*.

"Sir,—It may interest many of your readers to hear that on February 19 last, while travelling by train from Hyderabad to Quetta, and shortly after passing Sibi, in the Bolan Pass, I, my wife, and a Miss Mayo, who was travelling with us, all clearly saw a maneless lion.

When first seen it was lying on the ground eating a goat, and was at about 25 yards' distance. It then arose, and, with the goat in its mouth, darted back about 10 yards, when it stood sideways on with head erect and the goat still in its mouth.

It was a large lion, very stocky, light tawny in colour, and, I may say, that no one of us three had the slightest doubt of what we had seen until, on our arrival at Quetta, many officers expressed doubts as to its identity, or to the possibility of there being a lion in the district.

Personally, I am convinced that we saw a lion.

Yours faithfully,
PHILIP DUMAS,
Admiral.

Betchworth, Surrey.

(Lions were not uncommon both in Persia and Baluchistan in comparatively recent times. It is not impossible that a few survivors may still exist and though they are stated to be extinct, there is no definite proof of this. There being no tigers in Baluchistan a tiger cannot have been mistaken for a lion, and if the animal proves to be an Asiatic lion it will be a matter of very great interest.—Eds., *Field*)."

A similar letter, written to the London *Times* by Admiral Dumas, was the subject of considerable comment. A number of correspondents, some with first-hand knowledge of conditions in the area cast doubts on the likelihood of lions being found in the vicinity of the Bolan Pass, firstly because the terrain is wholly unsuitable and would provide nothing on which lions could habitually live because of the great scarcity of animal life in this inhospitable region. Again it is suggested by 2 or 3 correspondents that the animal seen by the Admiral was probably a panther. It is within the experience of those accustomed to seeing larger carnivores in the wild state that colour and pattern may be deceptive and that even the spotted coat of a panther may under certain conditions of light take on a uniformly drab appearance. Curiously enough a lion reported some years ago to have been killed on the Baluchistan border in the Bombay *Times* on investigation by the Society turned out to be a panther. Lions have not been seen or heard of in Baluchistan and there is no authenticated record of their occurrence in the province. It seems extraordinary that Admiral Dumas's record should be the isolated instance of their occurrence during the many years of British occupation and in spite of the fact that the Bolan area is continuously travelled over, resided in or visited by Railwaymen and others. The top of the Pass is only 25 miles from Quetta and there is a good road connection.

As regards the lion in Persia—Ronald Sinclair in a letter to the *Field* (reprinted in vol. xxxv, p. 671 of the Society's *Journal*) states that he was told by an Englishman that a party of American engineers concerned with Railway construction in the wild and mountainous region around Dizful in South-West Persia, came upon a full grown pair of lions; being unarmed they were compelled to beat a hasty retreat. This was in 1929. Edward Thomas in commenting upon Admiral Dumas's letter states that a lion cub was brought to an Arab village near Sanniyat, Mesopotamia, in 1916. In the same year he was told that a lion was shot in the Wadi Marshes towards the Pusht-i-kuh Mountains. He also refers to a letter published in *the Times* giving an account of a lion seen near Ahwaz in 1917. All these records relate to the Provinces of Luristan and Khuzistan on the Mesopotamia border in South-West Persia.—Eds.].

II.—A PAIR OF INDIAN LIONS PRESENTED TO THE BRITISH MUSEUM BY H. H. THE NAWAB OF JUNAGADH.

In a foot note to my paper 'The Lions of Asia' (*Journ., Bomb. Nat. Hist. Soc.*, xxxiv, pp. 638-65, 1930) the editors of this *Journal* announced that H. H. the Nawab of Junagadh was kindly arranging to shoot two Gir Forest lions for the National Collection, which, as I had announced, possessed at that time no specimen, complete with skin and skull, of this interesting beast. In 1934 a splendid adult pair was received from His Highness, to whom the trustees of the British Museum are greatly indebted for the generous gift, supplying a long-felt want. Since no report upon these specimens has yet been published and since every item connected with this vanishing race should be recorded, I take this opportunity of describing the skins and skulls as a supplementary note to my paper quoted above.

The lion carries a small mane of about the same size as in Capt. Smee's original example of this race, the hairs on the crest being about 2 in.; on the side of the neck 3 in., and lower down towards the fore leg up to 6 in. The fringe on the cheek and about the ears is rich ochreous; there is a good deal of black and grey in the crest on the fore-nape and a mixture of black, grey and tan extends across the front of the shoulder to the breast. The general colour of the body is dull tawny, not reddish or blackish tawny as in some Indian lions, the hairs being buff or greyish buff with darkened tips; the back is darker than the flanks, the lower flanks being clear buff, passing into creamy buff on the belly and inside the limbs; the forelimb is paler and greyer than the body, with a quantity of black hair between the digits and around the pads; the elbow-tuft, as in most Indian lions, is better developed in proportion to the size of the mane than in African lions, consisting of a whorl of black and grey hairs about 2¼ in. long, but there is no belly-fringe; the hind leg below the back and the paw are better tinted, more buffy than the fore leg; the tail above is grey, blackish-grey towards the end, and the tuft is small, its hairs less than 2½ in. long.

The lioness is decidedly better coloured than the lion, the individual hairs being richer buff and their black tips noticeably more pronounced; the fore leg is much more richly tinted and resembles the hind leg and the hairs of the belly are longer, with long white tips. These two skins supply further evidence of individual variation in the Indian lion. I am unfortunately unable to compare them with the skins kindly lent to me in 1930 by the Field Museum, Chicago, and by the Bombay Natural History Society; but from my description of those skins they seem to be decidedly tawnier and less grey than the skin of the Chicago specimen shot by the late Col. Faunthorpe and to resemble most closely the skin of the young lion presented to the Bombay Society by the Maharajah Kumar Sahib of Kotah. From Capt. Smee's skin they differ in having the coat much shorter and sleeker, although shot in February, and the colour noticeably greyer tawny instead of rufous tawny.

The measurements of the two dressed skins are as follows:—

♂ Head and body, 6 ft. 4 in.; tail, 2 ft. 8 in.; total 9 ft.
♀ Head and body, 5 ft. 10 in.; tail, 2 ft. 7 in.; total 8 ft. 5 in.

These dimensions agree tolerably closely with those of the skins entered in the table on page 656 of my paper.

The skulls, both fully adult, are perfectly typical of the Indian race, except that in the ♂ the auditory bullae are slightly more inflated, although, as in those previously described, flatter than in average skulls of African lions. They have the high sagittal crest running into two exceptionally thick ridges on the frontal bones;

and since the publication of my previous paper I have been able to establish an additional characteristic of the skull of this lion, namely the shortness of the waist, the distance between the post-orbital processes and the suture between the frontal and parietal bones is less than in skulls of African lions which, in this particular, are more like the skulls of tigers. In the ♂ skull the intra-orbital foramen is duplicated on the right side only as in the two ♂ skulls sent by H. H. the late Maharajah Jam Sahib of Nawanagar to Rowland Ward; but in the ♀ skull the duplication occurs on both sides as in some other skulls.

The following table gives the measurements of the two skulls received from H. H. the Nawab of Junagadh together with those of the specimens sent by H. H. the late Maharajah Jam Sahib of Nawanagar, of which some of the dimensions were erroneously entered on page 664 of my previous paper. The skulls are measured in English inches, the teeth in millimetres.

History and Sex	Total length	Cond. bas. length	Zygom. width	Post-orb. width	Int-orb. width	Max width	Mandible length	Upper carnal	Lower carnal
Nawanagar ...... ad. ♂	13·4	12·3	8·9	2·3	2·9	3·8	9·4	37 × 18	25
,, ... ad. ♂	13·1	11·8	9·1	2·2	2·8	3·7	9·1	35 × 17	24
Junagadh ...... ad. ♂	13·1	11·8	8·8	2·1	2·8	3·6	9·0	36 × 18	25
,, ... ad. ♀	11·9	10·7	8·0	2·0	2·5	3·5	8·1	34 × 15	22

The incidence of the duplication of the intraorbital orifice in the skulls of the Indian lions in which it has been recorded is sufficiently interesting to recapitulate—

Orifice divided on both sides in 1 ♂, 2 ♀, 2 unsexed skulls.
Orifice divided on right side only in 4 ♂ skulls.
Orifice divided on left side only in 2 ♀ skulls.
Orifice undivided on both sides in 1 ♂, 1 ♀ skulls.

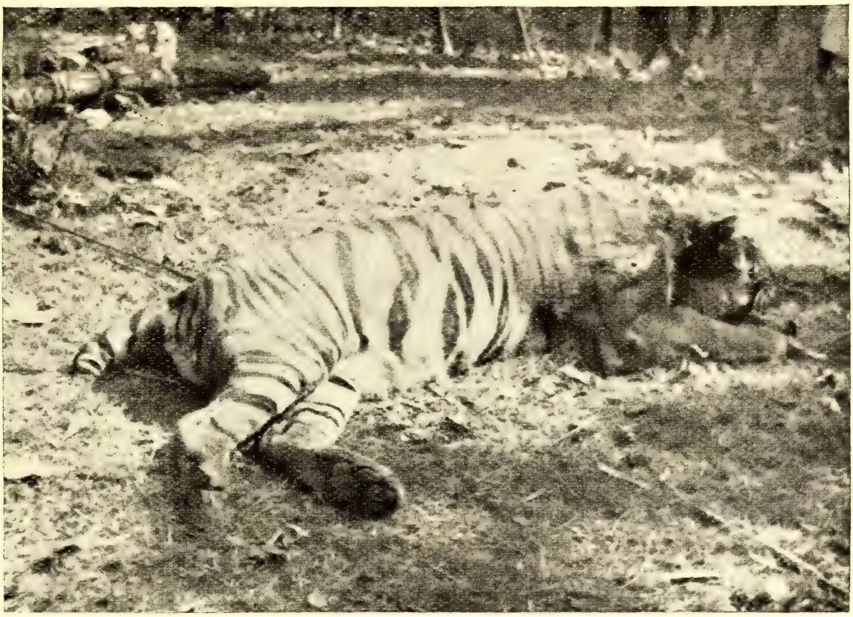
Thus in 13 skulls, 11 have the orifice divided on one or both sides; 2 only resemble African lions in having it undivided; but the data are not enough to justify the conclusion that, when the orifice is divided on one side only, the tendency is for the modification to affect the right side in ♂ skulls and the left side in ♀ skulls.

ZOOLOGICAL DEPARTMENT OF THE
BRITISH MUSEUM (NAT. HIST.), R. I. POCOCK, F.R.S.
LONDON.
June 12, 1935.

III.—A SHORT-TAILED TIGER.

(*With a photo*).

The Minor Chief of Udaipur State, E.S.A., shot with me yesterday a tigress measuring about 9 ft. in length. It had a very short tail. On examination it was found that the tail might have been damaged during its infancy. The tigress was an old beast. It resembled greatly the tailless tiger shot by Mr. R. C. Morris, F.Z.S., on 1st May 1934, a photo of which appeared in the *Journal of the Bombay Natural History Society*, vol. xxxvii, No. 3, of 15th December 1934.



A 'close up' of the tiger showing the short tail.

AMBIKAPUR,
SURGUJA STATE. MAHARAJA OF SURGUJA.
April 27, 1935.

[In a subsequent letter the Maharaja states that he is of the opinion that the shortness of the tail resulted from an old injury.—EDS.].

IV.—A CASE OF TIGER EATING SALT-LICK EARTH.

While Mr. C. McCann and I were collecting for the Vernay-Hopwood Chindwin Expedition in the evergreen forests at the eastern foot of the Naga hills in Upper Burma we came on a case of a large tiger frequenting a salt-lick and eating the earth, its droppings being full of it.

I think instances have been recorded of salt-lick earth being eaten by pregnant tigresses, but this was obviously a large male.

There were very few tracks of game, which was possibly due to the fact that the tiger had been practically living at the salt-lick for some time, in fact the Kachins putting up a machan came on his fresh form.

Honnametti Estate,
Attikan P.O., *via* Mysore,
S. India.
April 20, 1935.

R. C. MORRIS.

V.—TIGER FEEDING ON A LIVE COW.

In regard to Col. R. W. Burton's note in vol. xxxvii, No. 4, about a tiger feeding on a cow while yet alive, a case of this nature occurred at Bailur in the Kollegal Division of the Coimbatore District some years ago, a bait having been felled and partially eaten, by a full grown tiger, while yet alive.

Honnametti Estate,
Attikan P.O., *via* Mysore,
S. India.
July 12, 1935.

R. C. MORRIS.

VI.—DISTRIBUTION OF THE HUNTING LEOPARD (*ACINONYX JUBATUS* ERXL.) IN SOUTH INDIA.

In Part III of 'The Wild Animals of the Indian Empire' (*Jour. Bom. Nat. Hist. Soc.*, vol. xxxvii, No. 4), dated 15th April 1935, it is mentioned that the Cheetah or Hunting Leopard is not known to have occurred in South India. This however is incorrect. The Cheetah or Hunting Leopard has been found in Mysore, and the late Mr. C. E. M. Russell shot a male measuring 5½ ft. in length in August 1882 in the Berrambadi Forest of the Mysore District. Mr. Russell was then Deputy Conservator of Forests in the Mysore Service. The animal he saw was one of a group of five he came upon. This incident is recorded in Mr. Russell's book *Bullet and Shot in Indian Forest Plain and Hill.*

Col. Pollock in his book *Sporting Days in Southern India* also records the occurrence of the Hunting Leopard in South India, and, I think, I am correct in saying that my father, the late Mr. R. H. Morris, saw one near Attikalpur in the Chamarajnagar State Forest, Mysore District; this must have been sometime between 1890 and 1895.

Further, although Sanderson never saw a Cheetah himself, he records having seen two skins of the species which were shot by native shikaris.

Though this species was certainly unknown in Southern India Jerdon is quite correct in defining its distribution as 'throughout Central and part of Southern India, . . .'

HONNAMETTI ESTATE,
ATTIKAN P.O., *via* MYSORE,
S. INDIA.
July 8, 1935.

R. C. MORRIS.

VII.—A FIGHT BETWEEN A CAT AND A VIPER.

A fortnight ago when I was putting up in a thatched building in a village near Palghat I witnessed the following incident which I hope will be of some interest to readers.

The night was pitch dark. It was about 11 o'clock and I and my friend had just gone to bed when something heavy fell from the roof near my cot. I was startled and at once got up and lit a candle. I saw a cat and to my surprise a large Russell's Viper (*Vipera russelli*) which was hissing at it. Both my friend and myself drew back and watched. A regular fight was going on between the cat and the snake on the very spot where they fell down, neither yielding an inch from its position. Whenever the snake struck at its opponent, the cat spread its claws and struck at the Viper's head right and left. For half an hour the contest continued and all the time the cat fought so fiercely and struck blow after blow so quickly that the reptile had no chance of biting the cat. By this time, blood was jetting out from the snake's snout, its eye-balls were torn out and at last it fell unconscious. In a short time it lay motionless and dead.

The cat never used its teeth in killing the snake nor did it eat it.

The next morning when we spoke of the strange incident to some of our local friends they told us that such quarrels between cats and snakes are common in these parts and that the cats never eat the snakes but only kill them. They account for such quarrels thus: the cat goes in search of rats. The snake also visits the houses in search of rats. Occasionally the cat meets with a snake. The cat either mistaking the other for a rat or thinking that it is a new kind of food jumps at the stranger and the fight begins.

MAHIM.
April 25, 1935.

T. V. SUBRAHMANYAM.

[In vol. xxxiv, p. 256, we published a note on a fight between a cat and a cobra. The cat avoided the thrusts of the snake and struck in return before the snake could recover. The next morning the cobra was found dead with the head and neck torn to ribbons. Like mungooses, cats escape being bitten in encounters with snakes because of their extreme agility. Animals as a rule betray no instinctive dread of snakes—exceptions to the general rule are perhaps the monkeys and the higher apes. The suggestion that the cat mistook the snake for a rat is highly improbable.—Eds.].

VIII.—BANDICOOTS ATTACKING A COBRA.

From the 'Evening News', Bombay.

One day at about 11-30 p.m. I was talking with the members of my family when a servant came to me and informed me that a big cobra was near the kitchen window and that it was surrounded by five bandicoots.

I ran up to see the interesting encounter when to my great disappointment I found that some fifteen servants had assembled to watch the fight. One of them had a torch in his hand and they were making much noise discussing which would win. The light of the torch and the noise of the servants frightened the bandicoots who retired first followed by the cobra and I was unable to see the fight.

The servants related to me the following version, which is reliable, as all the servants who witnessed the fight corroborated what I am about to describe.

My cook, who was sleeping near the kitchen window, was aroused by a hissing noise outside. It was about 11-30 p.m., and full moon and the night was very clear.

The level of the ground is about five feet from the window. He peeped through the window and saw a big cobra coiled with its hood erect, surrounded by five bandicoots who were attacking it one after the other.

The most interesting part of it was that the bandicoots were attacking the snake alternately; when the cobra was being tackled by one in front, immediately two of the bandicoots ran at it from behind. They ran continually forwards and backwards, keeping at a safe distance and were very vigilant in retiring from the darts of the cobra.

I do not know who would have won the fight. So, any of your readers, who may have seen such a fight to the finish will oblige me by informing me through your paper.

Bombay. S. C. PETIT.

September 17, 1935.

IX.—BEHAVIOUR OF THE WILD DOG (*CUON DUKHUNENSIS* SYKES).

There have been many interesting letters to the journal describing the behaviour of the Red Dog. To what has been said I would like to add something from Burma, where the wild red dog is fairly common in certain localities.

The Shans, and I think the Burmese, believe that the red dog blinds its victim by squirting its urine into its eyes. This singular and acrobatic feat sounds ridiculous, but it is always worth while investigating native superstitions and beliefs about wild animals, and so I record it in case anyone would like to test it for himself. It would not be difficult to obtain some urine from a dead red dog, and put some of it into the eye of a goat, or other animal, and see whether it had any blinding effect or not. Is the belief held in India, I wonder?

I have heard that the red dog blinds its victim by biting out the eyes. I am satisfied that this is so myself, as the following account will show.

I was hunting Tsaine east of the Salween in Karenni, when about four o'clock in the afternoon, as I was making my way cautiously up a dry nala bed, I came suddenly on a small party of red dogs among the boulders of the chaung (stream). There were about five or six of them, and they just withdrew a short distance from out of my way, and waited. I shot one with a .318 rifle (solid bullet) through the shoulders, and it came tumbling down into the river bed. It was not dead, and the Shan hunter with me put the poor beast out of its agony by hitting it on the head with a big stone. Though in pain and anguish, the wild dog made no sound, nor did it attempt to bite the man.

To my surprise the other dogs did not clear off but waited in the vicinity without showing any fear. From time to time, I saw them moving slowly about among the bamboos. Then I noticed the reason for their presence there. They had just killed a large wild sow. The carcase was lying on its side in the chaung bed. It was still warm, and the only damage to it appeared to be that the belly had been ripped open and a few mouthfuls of meat eaten.

There were no jungle crows, kites, etc., about. One notices carefully the presence of such birds when big-game hunting.

I was surprised to notice on examining the pig that the eye on the top side was missing. Knowing the belief held by the natives that wild dogs bite out the eyes of their quarry, I turned the body of the pig over to see if the eye on the other side, in contact with the ground, was missing. It was. Both eyes had been cleanly whipped out. The eyelids had not even been torn. There were no other wounds on the head. We took most of the meat, but according to custom left some for the killers and continued on our way.

The Shans have a firm belief that the Porcupine is hermaphrodite. I shot one to see if there was any reason for this astounding belief. There was—most certainly. I could not tell the sex of the one I had shot from an examination of the external genital organs. It appeared to be hermaphrodite!!

On careful dissection at home I found that the 'penis' had no duct, but that the female organ into which it fitted admirably was normal, and led to the ovaries. I recommend anyone who is curious about this to dissect the genitals of a porcupine for himself!

TAUNGGYI,
S. SHAN STATES.
May 15, 1935.

T. R. LIVESEY.

[As regards the supposed 'hermaphroditism' in the Porcupine the belief probably arises from the fact that in porcupines, as in many rodents, the external genitals are not always in marked evidence. The penis of the porcupine (*Hystrix*) is habitually retracted out of view. It is bent backwards so that the prepuce forms a swelling a little beneath the anus. The testes undergo a periodical increase of size and change of position passing from the abdomen into a sessile scrotum and being retracted after the rut. The vasa deferentia or ducts which convey the seminal fluid take the form of fine tubes which might easily be overlooked by those unaccustomed to dissection.

That Wild Dogs sprinkle the bushes through which they drive animals with urine or jerk the urine into the victim's eyes with their tails and so blind them is a belief which is prevalent in many parts of India. In Burma they are supposed to destroy tigers and even elephants by this strategem. Hodgson and other naturalists have mentioned it in their writings, but as Blanford indicates, with the exception of Hodgson no one gives any credence to the story.

Blanford speaks of a similar belief in Europe in connection with wolves, though the strategy varies in this that the wolves dip their tails or their bodies in water and either shake themselves before a victim or work the water in its eyes and, before it can clear its vision, they take it in a combined rush. There is sometimes an underlying substratum of truth in legendary beliefs about animals, but it is quite impossible to indicate the basis of the present belief.—EDS.].

X.—RATELS AND CORPSES.

In Miscellaneous Note viii, at pages 952-3 of the *Journal*, vol. xxxvii, Mr. F. W. Champion invites readers to send in observations concerning ratels. In regard to the exhuming of corpses by this animal I am able to contribute the following:

In the year 1917, while in charge of a sub-division of the Central Provinces Government Railway Police, the body of an unidentified man was found on the railway track near Gondia. The local Sub-Inspector of Police and members of the inquest were of opinion that the deceased had been killed by a passing train. In accordance with custom the body was made over to sweepers for burial.

Some days later anonymous letters were received stating the identity of the dead man, and that he had been murdered. After certain verifications it was decided to have the body exhumed for medical examination. The writer, accompanied by an Indian magistrate, had the unsavoury duty of supervising proceedings. Enquiry showed that the burial had taken place in an area used for the interment of low-caste Hindus. This place was some distance from the town, and situated near a thick grove of trees on the bank of a deep 'nala'.

After the usual formalities to ensure the exhumation of the identical body, we arrived at the correct grave to find that it had already been disturbed. Rags and pieces of the skeleton were strewn about; there were two or three holes about a foot in diameter tunnelling into the grave; and it was perfectly clear that these had been made by some animal. The body had been thoroughly destroyed.

The sweepers, and a local Muhammadan constable who had accompanied me, said *Oode Masans* had done the exhuming. Not having heard the name *Oode Masan* before this, I became inquisitive and questioned several other persons standing around. The replies I received mystified me all the more, and it was decided, at the suggestion of the Muhammadan constable, to search the grove for the mysterious disturber of the dead.

The search resulted in two full grown ratels, with three half-grown youngsters, being dislodged from the hollow trunk of a dead tree. These escaped into the undergrowth and were not seen again.

I have no direct evidence that the ratels were responsible for this, and other exhumings indicated by the condition of several graves in the vicinity; but it is well known how negligent the poorer members of the low-caste Hindu community are in regard to the burial of their dead, such being frequently unearthed by hyænas, jackals, and other prowling scavengers. All the natives present were unanimous that ratels were the culprits.

The circumstantial evidence in this particular instance supports what Dunbar Brander has said about the ratel. I have on several occasions seen ratels at night in the beam from the head lights of a motor car; and on one occasion stopped a car within four feet of one of these curious little animals while he was having a dust bath in the middle of the road. This was some miles from Balaghat.

THE LODGE, L. E. CLIFFORD HURST,
COONOOR. *Indian Police.*
June 3, 1935.

XI.—SLOTH BEAR (*MELURSUS URSINUS* SHAW) ATTACKING A LIVE BAIT.

I am writing to inform you of a somewhat curious happening I met with a month ago. I generally tie up goats on a platform about 4 to 5 feet high in order to make no mistake against a bait being killed by a hyæna. I was sitting over a bait tied up in this way when a bear came out and killed the bait on the platform. The light being somewhat poor I could not at first clearly make out what it was. This happened about 8-30 p.m. and the sky was cloudy. When the moon came out of the clouds and shone on the surroundings I was surprised to see a bear on the platform. I shot the bear then. On examining the kill closely I saw that the bear had bitten the goat near the nape of the neck. It had eaten very little, but the whole skin on one side of the goat was completely torn off with tattered bits left here and there. In Kashmir, bears do kill bullocks and calves but a sloth bear acting in this way seems somewhat curious. The bear killed was a male measuring 4 ft. 10½ in. between uprights.

AMBIKAPUR,
SURGUJA STATE. MAHARAJA OF SURGUJA.
April 25, 1935.

[In the *Journal* (vol. x, p. 690) there is a note by Reginald Gilbert who writes of a sloth bear attacking a buffalo tied up as bait for tiger.—EDS.].

XII. AGE OF PUBERTY IN THE INDIAN ELEPHANT (*ELEPHAS MAXIMUS* L.).

With reference to the note on page 960 of volume xxxvii concerning the time of sexual maturity of the elephant, it may be of interest to record the details of the elephant 'Wästl' born in captivity at the Münchener Tier Park on the 8th. May, 1932. The father, 'Boy', was nine years old and the mother 'Cora' eight years old. The elephant was conceived at the end of August 1930 and the period of pregnancy was only 20 months and 7 days; the accepted time of pregnancy of elephants is between 22 and 24 months. There is reason to suppose that the birth in this case was premature as the baby could not reach its mother's teats when it was first born, and even when he was fed from the mother in a lying position the milk was unsatisfactory and for the first twelve days he was fed by bottle. The milk from the mother was a thin and watery fluid containing only 4 per cent of fat instead of the normal 22 per cent. The baby at birth weighed only one hundredweight instead of the usual two hundredweight. These particulars are taken from the June 1932 number of the magazine *Das Tier und Wir*, published monthly by the Munich Zoo which contains a series of extremely attractive photographs of the baby and its parents.

THE DOON SCHOOL, CHAND BAGH,
DEHRA DUN. A. E. FOOT.
June 9, 1935.

XIII.—SOCIAL BEHAVIOUR OF BISON (*BIBOS GAURUS* H. SM.).

Mr. J. William's note on the Social Behaviour of Bison in vol. xxxvii, No. 3, is interesting in that it supports my previously recorded views regarding the mastership over herds during the breeding season frequently enjoyed by solitary bull bison; in other words, in my opinion both in the case of bison and elephant many bulls lead a solitary existence voluntarily and have not necessarily been turned out by younger bulls. I have observed 'solitaries' join and assume mastership of a herd during the breeding season late in the afternoon leaving the herd again soon after daylight.

In regard to dewlaps, bison without dewlaps and with varying degrees of dewlaps are to be found in any district in South India where bison occur in numbers.

Honnametti Estate,
Attikan P.O., *via* Mysore,
S. India.
July 12, 1935.

R. C. MORRIS.

XIV.—THE 'WHITE' BISON (*BIBOS GAURUS* H. SM.) OF SOUTH COIMBATORE.

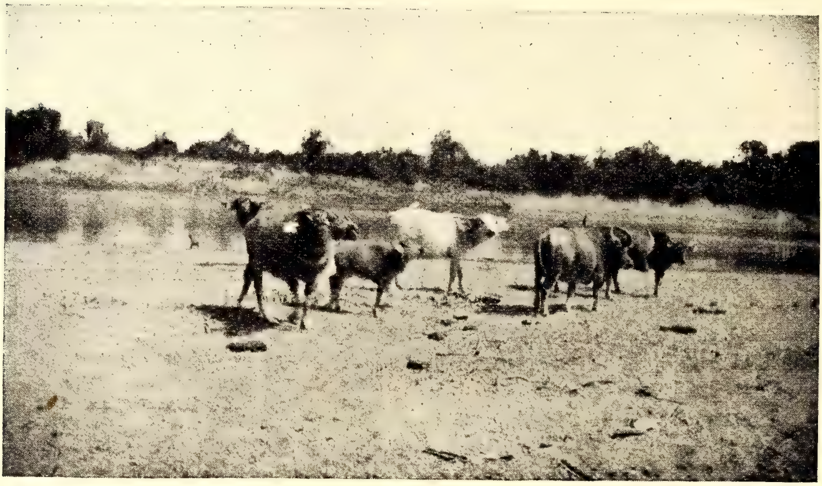
(*With a photo*).

I have read Mr. Dunbar Brander's note on the above in your *Journal* of the 15th July 1935. I do not agree with Mr. Dunbar Brander that my description 'sandy or light fawn' is identical with 'dormouse coloured', but this is a matter of opinion. Mr. C. C. Wilson's description of the 'White' bison of South Coimbatore as 'very light cream', is really a more correct definition of their colour.

Mr. Dunbar Brander claims to have had equal experience of bison as Mr. Wilson, but this statement is at variance with his book 'Wild Animals of Central India' in which he admits not having had much experience of bison. However, it is obviously futile to continue this argument. Mr. Dunbar Brander has not seen the South Coimbatore 'white' bison, and, therefore cannot possibly tell how they compare with the bison he claims to have seen in the Central Provinces.

It would be interesting to learn the area in the C. P. the light coloured bison are to be found in, if they still occur, or whether they have been seen lately. It is certainly remarkable that their existence has never been recorded by previous authors or the Bombay Natural History Society.

I have not yet been able to take photographs of the South Coimbatore 'white' bison, but I had an opportunity while in Upper Burma recently of taking photos of similar abnormal colouration in the case of semi-domestic buffalo on the banks of the Chindwin, The colour of these 'white' buffalo is identical with that of the 'white' bison in South Coimbatore, and the enclosed photo will show how they compare with normal coloured buffalo: and the comparison is very similar in the case of the bison.



A herd of semi-domesticated buffalo on the Chindwin River.

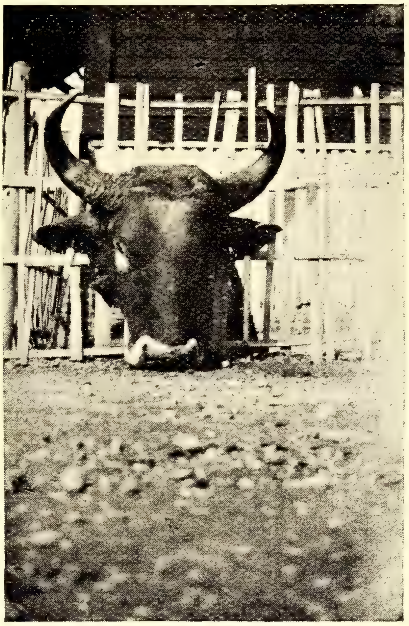
HONNAMETTI ESTATE,
ATTIKAN P.O., *via* MYSORE,
S. INDIA.
May 14, 1935.

R. C. MORRIS.

XV.—LENGTH OF HORNS IN TSINE (*BIBOS BANTENG BIRMANICUS* LYD.).

It would please me much, if you could give me some information on a few things I wish to know regarding Tsine (*Bibos banteng birmanicus*).

A few days ago, a friend and I went out after these animals in the Katha District. The jungle was in perfect condition for tracking, rain having fallen heavily in those parts. I returned to our camp empty handed, but heard two reports of my pal's rifle. He returned with the news that he came upon a pair of old bulls, and wounded one rather badly, the other one escaping intact. He was rather timid to follow the blood trail, as tsine are somewhat vicious when wounded. I followed up the next morning from where my friend left off, and tracked it till about 4 p.m. without catching sight of it. I went after it again next morning, but could not find fresh tracks, as rain had fallen and obliterated them. I was rather annoyed, and kept moving about in circles, hoping to find tracks made after the rain had stopped. I eventually came on a spot where an animal had rested, and found tracks at the most about one hour old. I hung on to them, and was rewarded by seeing a massive brute about twenty paces away. My .404 rifle did the rest, and I was quite surprised to find that the animal was not the one wounded by my pal. There were only two wounds, and these were caused by my rifle. I am inclined to think that after one animal had been shot at and left, the other made off and met him later. The Burman who accompanied me agreed that such was the case, and that the one I had killed had abandoned his wounded companion. A word now about my animal.



Head of a Tsine (*Bibos banteng birmanicus*).

Colour: Almost totally dull black with dark brown towards the stomach. Buttocks dull white, also the stockings.

Length along curves: Tip of nose to root of tail 8 ft. 6 in.

Length of tail without hair: 3 ft. 1 in.

Height: 6 ft. 2 in.

Weight: I should say about 350 to 400 viss.[1] The pelt alone weighed 35 viss.

Horns: Very poor for such a huge beast. Corrugations very pronounced.

The measurements taken are as follows:

	Left.	*Right.*
Length	20½ in.	20 in.
Girth	18 ,,	17¾ ,,
Corrugations	6 ,,	6½ ,,

Other measurements are:—

Widest outside	28½ in.
Widest inside	23½ in.
Sweep (across forehead)	53 in.
Tip to tip	21 in.

Colour: Black at corrugations. A sort of biscuit shade in the middle, black tips.

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[1] 1 Viss = about 3½ lbs.—Eds.

Can you assign any reasons for such small horns in an old animal? The country is hilly, grass, fruits, and water plentiful, and on the whole I do not think more ideal conditions prevail in other districts. I have seen better heads on young bulls, and shall be thankful to have your views on the subject.

SAGAING, BURMA. D. A. DE LASTIC.
June 18, 1935.

XVI.—HABITS OF THE HOG DEER (*HYELAPHUS PORCINUS* ZIMM.).

I notice that in your recent publication *The Wild Animals of the Indian Empire* reprinted from the Society's *Journal*, vol. xxxvii, No. 1, the following remarks are made concerning *Hyelaphus porcinus*, the Hog Deer. 'Hog Deer are generally solitary creatures . . . sometimes small parties of 2-5 may be seen grazing together.' And this in my experience is usually the case in Assam. I thought therefore in view of the above that you might be interested to hear of a recent experience of mine in the Kuziranga Game Sanctuary of this province (Assam). While out on elephants one morning looking for Rhino, of which we saw thirteen, including a young one, during the few days spent in the Sanctuary, we came across a herd of over eighteen Hog Deer feeding together in a small 'doloni' (swamp). They consisted of one fine stag with a very good head, several young stags, and the rest hinds, some with young. They were all feeding together and we were able to watch them for some time from the elephants. Finally they moved off into the Ekra jungle surrounding the doloni and we slowly made our way through the herd. The whole thing certainly looked like being a family gathering and not merely a number of animals that had collected in the same place by chance on account of the good grazing to be found there.

It would be interesting to know whether there are any other records of such a large number of this species being seen together.

NOWGONG,
ASSAM. J. B. ROWNTREE, I.F.S.
June 18, 1935.

XVII.—DISTRIBUTION OF CHITAL (*AXIS AXIS* ERXL.) IN ASSAM.

In the article *The Wild Animals of the Indian Empire*, under the Chital or Spotted deer at page 75, Part II, it is mentioned that Chital are unknown in Assam.

This is not correct. I have got several herds of them in my Division, District Goalpara of Assam and I believe it occurs even further east. I hope you will make enquiry about this from our

Conservator of Forests, Shillong, who has a vast knowledge about wild life in Assam.

DHUBRI, ASSAM. R. N. DE, I.F.S.
May 10, 1935.

[In reply to our letter, Mr. A. J. W. Milroy, Conservator of Forests, Assam, wrote as follows:—

'With reference to your letter dated the 13th May 1935, I can inform you that the spotted deer is found north of the Brahmaputra in small herds apparently isolated from each other in north Kamrup and Darrang as far east as the Dhansiri river, beyond which it has not been recorded. Its occurrence south of the Brahmaputra is unknown.'—EDS.].

XVIII.—THE STATUS OF THE BROWN SHRIKE [*LANIUS C. CRISTATUS* (LINN.)] IN THE S. S. STATES, BURMA.

In the S. Shan States the Brown Shrike is a fairly common bird in the winter, and I have noticed odd single birds about as late as June, which would suggest that a few non-breeding birds remain in the Shan States throughout the summer.

All the birds I have noticed hitherto were in the sombre pale, barred plumage, but this year in May, I noticed here some in full breeding plumage, with the conspicuous and heavy black line through the eye.

This full plumage was unknown to me as I have never been in the breeding area of this shrike. It is as unlike the usual cold weather barred plumage as to suggest another species.

I should be interested to know whether the Society has skins of this Shrike in the full, clear and unbarred plumage that have been taken in the cold weather in India and Burma, as I am inclined to believe that this Shrike has *two distinct phases of plumage*—the pale brown, barred plumage, with the brown line through the eye, in the winter; and the full clear breeding plumage, not barred, with the black line through the eye, in the summer.

It is most unlikely that all the birds I have seen in the cold season have been in immature plumage—and not a single one in full plumage.

As I have never observed any but single birds in the summer here, I conclude that the brown shrike does not breed in this part of Burma.

TAUNGGYI. T. R. LIVESEY.
May 15, 1935.

[It would be useful if Mr. Livesey collected specimens of the two colour phases to which he refers. As known at present, the Brown Shrike is not dimorphic, either seasonally or sexually. First winter birds differ from the adult in having the band through the eye brown instead of black, but occasionally the brown band is retained in the adult. The crescentic barring on the lower plumage is much greater in amount in first winter birds, but also persists in most adults in a more or less obsolete form.

As far as we are aware, there are no records of this Shrike breeding within Indian limits south of the North Cachar Hills.—Eds.].

XIX.—HABITS OF THE BURMESE STONE CHAT (*SAXICOLA CAPRATA BURMANICA* STUART BAKER).

The Burmese Stone Chat is the common little black and white chat of the uplands of the Shan States, and especially numerous between 3,000 ft. and 6,000 ft. He is a typically perky little fellow, with the characteristic short tail of the stone chats. The cock bird is black with glistening white wing patches, and white upper and lower tail-coverts. The hen is a quiet little reddish brown bird with a paler patch on the upper tail-coverts. The cock when perched may, or may not, show the white wing patches. That depends on how he chooses to hold his wings. These white wing patches of his are his conceit, to be shown off to advantage during his little love-flights round the hen, or during his display from the top of a twig.

They are cheerful birds that take kindly to the presence of human beings, for they love the open cultivated lands where they feed and breed. They are possibly on the increase with the extending of field lands.

The cock has a pleasant and trilling little song, full of tenderness and passion, which he indulges in at intervals all through the day. He starts before dawn, and I have heard him give a few, low but enthusiastic notes during the night when there was a moon. He likes to give his song during a love-flight over the area he has chosen as his very own for the nesting season. Then he shoots up into the sky, and then round and round in great wide dips for such a tiny bird. Short but sweet—

'And when his song is done at last . . .
My heart beats just as fast!'

And hers too no doubt.

There are two hill tribes in the Shan States, among others, to whom the engaging little ways of this bird are well known. They regard these little chats that share their cultivation with them with interest and affection. They know too that they are the commonest fosterers of the cuckoo (*Cuculus c. bakeri*). These two tribes are the Taungyo and the Taung-thu. To the former this chat is known as '*Paul-ling-nget*', with the accent on the 'ling' —and to the latter as '*Laung-tha*'.

In Burma they extend as far south as Karenni, parts of which are bare and dry country.

It is as a fosterer of the cuckoo that I have been especially interested in this chat. It is surprising, if one specializes in finding the nests of a given species, how expert one becomes after a few years. I can now always find the nest of any pair of chats, when they have one. I admit that it sometimes needs persistence, and some patience with the field glasses, especially if the nest contains but one or two eggs, or has not yet been laid in.

In the Shan States this chat is by far the commonest fosterer of the cuckoo—I should say at least six times as favoured as any other species. Although the cuckoo's eggs adapted to this chat agree pretty well in general colour and markings, they never show the delicate greenish blue ground colour of the chat's eggs. The cuckoo's egg is nearly twice the size of the chat's, but I have noticed no desertions. They seem to take very kindly to being imposed upon by the cuckoo, and after much observation, I am inclined to think that, far from resenting the cuckoo's attentions, they even seek to attract the cuckoo!

These chats pair off and take up their areas for nesting early in March. Perhaps they are paired throughout the year, but I think not. Eggs are laid in March, but April is the main laying month, and thence on to the break of the monsoon about the middle of May. The heavy rains flood out and destroy most of the nests of those that try to bring up a brood later on.

Having settled on their respective areas after a good deal of fighting and song contests, the cock birds mount guard over their estate and can be seen a long way off sitting on some prominent twig top, or on a bamboo fence or some such point of vantage from which to 'see off' all rivals of the same kind. An ordinary sized field will hold a single pair of chats but a large field may have two or more pairs nesting in it. Much depends on the lie of the land. Out of sight in such cases is often out of mind. The chat is quite friendly disposed to visiting bulbuls and other birds; what he cannot tolerate is a raid from another chat. The only other bird that seems to excite him, and his wife, is the cuckoo. They are greatly excited at the visit of a cuckoo. They fly up at once to meet the cuckoo and sit by it, and flutter round from time to time. Then very often the hen chat will fly off straight to her nest, and so give it away, so it seems to me, to the cuckoo! . . . And yet it is all very puzzling for on occasions the cuckoo will descend on the chat's nest and eat one of the eggs![1] But perhaps they are willing to run the risk of the loss of their eggs for the favour of a wonderfully large baby!

They are exceedingly cunning in secreting their nests; and in preserving the secret when once the nest has been made. The cock bird mounts his faithful guard and at once gives warning to his mate if anyone is about. As you step into the field the hen bird sneaks off her eggs, even when they are hard set, and her dull brown plumage and low flight over the brown earth defeats the eye. If she, or he, have been surprised, then she may sit tight on her eggs and only fly up at your feet. But that is quite exceptional—a bad blunder! As a rule to find the nest it is best to retreat to a considerable distance, to the next field, and watch with field glasses for the hen bird to return to her nest. Then the exact spot must be carefully marked.

The favourite nesting site is out in a ploughed field under a clod of earth, but any broken ground may serve the purpose. After a bit one gets to know exactly the kind of place where the nest is likely to be. Another favourite place is in a stubble field where there are clods of earth lying about. Other sites are on open waste lands, and on hill sides and in gardens, but never within forest. If in light scrub, then always near an open space in it. Often the nest is placed under a rock, but again nearly always in the open, or at the foot of a bush or tuft of grass, but not within the cover, on the outskirts of it. Sometimes they nest in the hollow of a section of bamboo lying out on open ground, and I have taken a cuckoo's egg from such a nest which no cuckoo could of course possibly get its body into. Under an old tin too is often a favourite place, and I have found a nest inside an old kettle. Then banks are freely made use of, and broken nalas, the nests being placed in some hole in the side of the bank. Such nests are the most obvious of all. But here again on open ground, and not in banks along forest paths as chosen by the Dark Grey Bush Chat. Sometimes the nest may be cleverly hidden in a deep hole in the ground and only yield to discovery after a prolonged exploration.

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[1] Is this to test the state of incubation?

In such narrow little places, under clods of earth and in crevices, the eggs are often quite out of sight as one peers in, but the edge of the nest is nearly always to be seen. Those under clods can only be examined by getting the eye down to ground level. Rarely is it possible to get an egg out, even with two fingers, without damaging the nest and causing a fall of earth into it. In such narrow places the egg of the cuckoo is found, and how exactly the cuckoo gets it in there still remains a mystery. I have often found, I did yesterday, a cuckoo's egg lying on the edge of the nest some four inches away from the chat's eggs. Whether the chat in such cases has 'footballed' the cuckoo's egg out, or whether the cuckoo has laid or deposited it there outside, is a mystery also.

The full clutch of eggs is five; but six are sometimes laid. Often four only are incubated. They are handsome and well marked, pale greenish-blue with rusty red spots and markings which are heaviest at the larger end where they generally form a cap, or zone. A pale egg is often found in a clutch. The eggs vary much in size in different clutches. Cuckoo's eggs never seem to be so definitely marked as the chat's; they are distinctly paler, and, as I have said, never seem to show the greenish ground colour. Their red markings are lighter in tone than those of the chat's eggs.

Pale blue, immaculate eggs laid by cuckoos adapted to the Dark Grey Bush Chat are frequently found in nests of the Stone Chat. In such cases the contrast is quite startling, but I have noticed no desertions on that account. These are probably placed in Stone Chat's nests *faute de mieux* as the Dark Grey Bush Chat is getting scarcer every year round villages and towns owing to the ruthless destruction of trees and vegetation that goes on.

When a chat has eggs the cock bird will follow all your movements, while the hen will hide discreetly away until the danger has passed. If they have young ones both cock and hen will be very agitated and keep up a continual calling of their anxiety as they wait upon the intruder.

When a brood has been successfully reared, the whole party keeps together for some time, ten days or more, after which I suspect the old birds to have a second brood, or an attempt at it if the monsoon does not intervene.

No one can paint such an accurate and charming picture of a bird in a short sentence as Mr. Stuart Baker can, and his description of this chat's feeding '. . . catching insects on the ground by making little sallies from some point of vantage', is perfect. They never stay more than a few moments on the ground though, but soon fly up again on to a twig, or grass stem, so as to be able to look round. This helps one to find the nest, as if a bird goes to ground for any considerable time it has probably gone to its nest.

The cock chat is an admirable little husband and helps to build the nest, and is given to scratching out nesting cavities on his own sometimes. He does not, however, ever incubate the eggs but keeps to his job of mounting guard over the nest so as to warn his wife of any danger.

Both sexes carefully tend the young, and bring them food every few minutes.

I suspect there is a slight up and down migration of this chat, and that they come up to the high lands to breed and go a bit lower and explore afield during the cold season. They are to be seen out in the reeds on the Inlè Lake in the cold weather though not far from the banks.

In conclusion, mention may be made of the other kinds of birds that nest about the same time as the Stone Chat, and in somewhat similar places, under clods out in the open fields. These are the Skylark (? Chinese race, but at lower elevations, 2,000 ft. to about 3,200 ft.), the Crested Bunting, and the Indian Meadow Pipit. Cuckoos are parasitic on them all to some extent.

TAUNGGYI,
S. SHAN STATES, T. R. LIVESEY.
BURMA.
May 1, 1935.

XX.—CUCKOOS IN THE S. SHAN STATES.

The cuckoos are back, but in the vicinity of Taunggyi (4,700 ft.) I did not see them till 28th March, which is late. Usually they are here, and begin to call, about the 15th. I have heard them as early as the 9th.

I have never heard of a satisfactory explanation for the apparently hawk-like appearance of the cuckoo. Perhaps it is only hawk-like to our eyes. It does not seem to frighten birds at all, though it excites them. Then, if it is really true that the cuckoo (*Cuculus canorus bakeri*) mimics the hawk, what hawk does the little Plaintive Cuckoo mimic? There is no minute sparrow-hawk.

I think there must be some other explanation. Frequently a cuckoo will perch on some lofty bough, the top of a bamboo for instance, and he will be joined by a Stone Chat. The Chat seems to gaze in rapture at the cuckoo only a couple of yards off. The expression on the Chat's face appears to be one of rapture, not fear. He is very interested. The cuckoo too stares in a stupid fowl-like way. So they sit like this for a considerable time.

What passes in their minds?

It is possible that the Chat has been the foster parent of one, or more, cuckoos in past years.

If the Chat resented the cuckoo, he would not seek to sit by him. And surely they would refuse to bring up a young cuckoo when they recognised it as a parasite.

Perhaps the chat regards the cuckoo with admiration, and seeks to attract him.

The male cuckoo, I believe, sits on some prominent bough at the top of a tree for the same reason that the hen does, to watch the terrain round about for signs of a chat's nest. I have seen a male cuckoo fly down to a chat's nest that contained eggs, and then pass on. He did not do so to eat the eggs, for he did not disturb them. It would appear that he did so to see if the nest and eggs were in a suitable condition for the deposit of the female cuckoo's egg. And that he would show her the nest, if suitable, later on, thereby gaining her favour.

From signs I have seen here, the cuckoo lays her egg very late in the day, at almost sunset time, which makes observation very difficult in the failing light.

There are many cuckoos here that lay a pale blue, immaculate egg, which appears to be adapted to the Dark Grey Bush Chat (that lays unmarked eggs in Burma). These eggs are most usually found, as one might expect, in the nests of that bird; but as the Bush Chat has become scarce now in the vicinity of Taunggyi, owing to the general destruction of trees and bush lands, these cuckoos laying the blue, unmarked eggs, have to find some other species to receive them. So it is that these blue eggs are frequently found now in the nests of the Stone Chat. Then the contrast is most marked, though I have not noticed any desertions on that account.

I have seen only one cuckoo's egg that was pale blue with a few, sparse red markings on it. This one egg struck me at the time as being the effort of a hen cuckoo hitherto laying a pale blue, unmarked egg, adapted to the Bush Chat, now trying to adapt herself to lay an egg suitable for deposit in the nest of the much commoner Stone Chat. It is an interesting suggestion. Surely *Desire* plays a very important part in evolution, though it is hardly ever referred to by Biologists. It cannot be measured! In the human race the *Desire* of the race brings about the particular type of beauty of the women (and men) of that race. If not, how can we explain the persistence of the 'almond', Mongolian eye in the people that have lived countless ages in hot tranquil lands, far removed from the windswept heights of central Asia? It was admired, and so retained, if not further emphasised.

It is interesting to record that a Koël was here, and calling, for many days this year. It came up as far as my house which is about three hundred feet higher than Taunggyi. That would make it about 5,000 ft. above sea level, a height I have not heard of a Koël attaining to before. It soon left as there was no house crows to victimise.

Since writing the above a female cuckoo came and sat on a small tree 150 yds. in front of my house. She was at once joined by a cock chat who sat within 4 ft. of her, and above her, for about ten minutes. The chat was quite happy near the cuckoo, and ruffling out his plumage from time to time. The cuckoo stared stupidly. Then the hen chat joined them for a few moments and then she *flew straight to her nest about 20 yards* from the tree.

It is my opinion that the chats deliberately *show their nest* to the cuckoo and court the cuckoo's attention, and wish it to deposit its egg in their nest.

TAUNGGYI,
S. SHAN STATES,
BURMA.
May 1, 1935.

T. R. LIVESEY.

XXI.—SPEED OF THE GOLDEN ORIOLE (*ORIOLUS O. KUNDOO* SYKES).

Some time back, while motoring, I had an opportunity to observe the speed of this beautiful bird on wing. The road passed through a dense jungle of mango trees. A pair of Golden Orioles was flying from tree to tree and kept parallel to the road for about a couple of hundred yards. The speed of the birds was about 25 miles per hour.

NAVO VAS, DANA PITH,
AHMEDABAD.
April 21, 1935.

H. N. ACHARYA,
F.Z.S., F.R.G.S.

XXII.—ON THE OCCURRENCE OF THE IBIS-BILL (*IBIDORHYNCHA STRUTHERSII* GOULD) IN UPPER BURMA.

In a recent issue of the *Ibis* (April 1935) I recorded having seen a party of Ibis-bills on the Hpunchanhka, a stream in the Myitkyina district, about 150 miles north of Myitkyina, in December 1932. I unfortunately failed to obtain one, and so did Capt. W. M. F. Gamble who saw them in the same place a fortnight later. The occurrence of this species in Burma appears now to be beyond doubt by the accompanying skin of an adult bird shot by Mr. A. K. Thompson, Burma Frontier Service, at La-awn-ga in the Sumprabum Sub-division in December 1934, out of a flock of about twenty-five on the big shingle banks in the bed of the N'Tsi or Machi river, which here forms the southern boundary of the

Putao subdivision. I have little doubt that this bird will be proved to occur annually in winter on the streams in the northern part of the Myitkyina district, as it does in Assam, at a low altitude, though I searched for them recently without success in late March at both the above places.

MYITKYINA.
March 21, 1935.

J. K. STANFORD,
Indian Civil Service.

[The bird skin sent is that of the Ibis-bill (*Ibidorhyncha struthersii* Gould).—EDS.].

XXIII.—OCCURRENCE OF THE FLAMINGO (*PHOENICOPTERUS RUBER ANTIQUORUM* TEMM.) IN NORTH GUJARAT.

On 17th. April, I saw about forty flamingoes flying over the Chandola Lake, two miles south of this city. The birds were on the wing for the whole day and went away west as soon as it was night. This is the first time during recent years that they have been observed in this area, though I am told they were occasionally found in pre-war days. There are numerous lakes in this part of Gujerat, which are full of water all the year round; but so far as I know, flamingoes are not known to visit them. The nearest haunt of these birds is the Nul Lake, some 40 miles south-west of Ahmedabad, and I think the birds I saw may be a batch from that place on the return journey accidentally passing this place, which may be out of their regular route. They appeared to be conscious of the strangeness of their surroundings, as in spite of their attempt to settle somewhere on the banks, they seemed to be unable to make up their mind. It was a wonderful sight to see these beautiful birds flying round and round over the vast expanse of the water, sometimes in a group, sometimes in single file. They occasionally came so low that their feet were actually skimming the surface of the lake.

NAVO VAS, DANA PITH,
AHMEDABAD.
April 21, 1935.

H. N. ACHARYA,
F.Z.S., F.R.G.S.

XXIV.—SOME RARE BIRDS IN NORTHERN BURMA.

These notes are from the Myitkyina district of Burma and confirm scattered observations already made in the *Ibis* in January and April 1935.

Crypsirhina cucullata. Hooded Racket-tailed Magpie.

I recorded having seen a single bird on January 25, 1934, at Mogaung, where the rainfall is at least 90 in. It is usually considered to be a dry zone species, and I imagined this bird must have been a vagrant. On April 24 1935, however, Mr. J. M. Shapland and myself had a close view of a pair about six miles from Mogaung at Myothit in the Namti valley.

Further observation is clearly needed as to this bird's status outside the dry zone.

Suthora brunnea brunnea. Anderson's Suthora.

Already recorded in the *Ibis* from the Myitkyina-Yunnan border at Kambaiti. In May 1935 it was common from 5,000-7,000 ft., usually in pairs, though I saw one family party on May 24th; they were feeding in reedy grass or bramble bushes on open hill-sides, and were not at all shy. The chestnut head and vinous-pink breast of the adults were most conspicuous.

Sitta himalayensis. White-tailed Nuthatch.

I obtained a single bird and saw a family party at Kambaiti (6,800 ft.) in late May 1935.

Dryonastes nuchalis. Ogle's Laughing-Thrush.

This bird seems to be not uncommon from the plains up to 3,000 ft. in the dense growth following cultivation. It occurs near Myitkyina and on both sides of the Malihka up to Putao. I have seen it with *Garrulax gularis*, *Garrulax pectoralis* and *Dryonastes ruficollis*. It is a great skulker and hard to get a view of, but has rich and distinctive notes, and if seen, the black throat, white cheeks and dark slate-gray head are most distinctive.

Garrulax gularis McClelland's Laughing-Thrush.

I had one sent me by Mr. C. C. Fisher from the Putao subdivision in January 1935 and saw three others at close range on April 2nd 1935 with *Dryonastes nuchalis* at La-awn-ga on the Putao-Sumprabum border, in wild plantains. A very shy bird.

Fulvetta manipurensis. Manipur Fulvetta.

This bird is only known from Godwin-Austen's Manipur specimens, and five obtained near Kambaiti in August 1933 and April 1934 (*Ibis*, January 1935). I shot two more on December 29th 1934 between 7,000 ft. and 8,000 ft. near Lungrebum on the Myitkyina-Bhamo border, one of which was in sparse cane jungle on an open hillside, and the other with *Alcippe*, *Zosterops* and *Stachyris ruficeps* in evergreen tree forest. They look very like Tits and are smaller than *Alcippe*, which they closely resemble, except for the more rufous colour of the back.

The Yawyin name is 'Shu-di'.

[Iris in one pale pinkish-yellow, in one straw yellow; bill black; yellow at gape; legs and feet livid brown.]

Lioparus chrysotis forresti. Yunnan Golden-breasted Fulvetta.

I shot a male, which, I think, was breeding, at 7,000 ft. in cane and damp tree jungle on the Kambaiti Pass road in May 1935. It was not at all shy and kept returning to one place, but I could not find a nest. The only other authentic Burmese records are from this area.

Delichon urbica subsp.? House Martin.

I obtained three identified as *whiteleyi* in 1934. On January 19, 1935, I saw seven or eight *urbica* hawking low over bamboo jungle near Hwehka in the Jade Mines but had no gun with me at the time.

Collocalia fuciphaga subsp. ? Himalayan Swiftlet.

In three successive years these birds have appeared round Myitkyina in February and have not been observable at any other time. All these visitations coincided with local heavy rain and unsettled weather and probably they were driven down from the hills. The dates were:

1933. February 10-13.
1934. February 17-26.
1935. February 18-22.

In the 1934 visitation I obtained both *brevirostris* and *pellos*, flighting low over my garden. In late March 1935 I also saw a number in very cold, rainy weather feeding low over Fort Hertz.

MYITKYINA.
June 9, 1935.

J. K. STANFORD,
Indian Civil Service.

XXV.—NOTES ON SOME BIRDS OBSERVED BETWEEN YATUNG AND GYANTSE, TIBET.

Casarca ferruginea. The Ruddy Sheldrake.

These birds were observed in large numbers between Dochen Lake 14,600 ft. and Gyantse 13,100 ft. down the rivers. Several flights of up to 12 birds were seen but most of them were in pairs, some with broods of from 5 to 8 ducklings. On a Marsh about 5 miles from Kala 14,200 ft. after a bursting chase of 200 ft. I was able to catch one youngster out of a family of 5. It was still covered with down. Except for the pairs with broods these duck were exceedingly tame, and, mounted, I was able to approach to within 15 ft. of them without their taking fright. At Kala in the evening they were all in the fields of young crops.

Mergus merganser orientalis. The Eastern Goosander.

On 15th June after climbing up a hill to about 15,000 ft. from Tuna I surprised a pair of these birds which had been sitting amongst some bare rocks. They circled round quite close to me two or three times giving vent to their peculiar cry and then flew off rapidly towards a marsh some 400 ft. below. I saw another single bird 2 days later winging its way rapidly up the Tumbayung River.

Anser indicus. The Bar-headed Goose.

On 16th June near some warm springs about 3 miles north of Tuna 18 of these birds were congregated on the bank of a large pool. I was able to approach to within about 120 ft. of them before they took fright. They then flew up and circled round for about 5 minutes before finally retiring in the direction of Dochen Lake. Being short of meat I fired with my .355 Mannlicher into the head of the phalanx and by some miracle hit one through the neck. I saw no sign of any nesting here as they do on Rhamtso Lake.

Grus nigricollis. The Black-necked Crane.

Two pairs of these beautiful birds were seen. They have a similar cry to that of the Sarus Crane. I did not have an opportunity to study them for any length of time. Neither pair appeared to have any brood, though I was told that one pair had a nest in Dochen Lake somewhere.

Gypaëtus barbatus grandis. The Lämmergeyer.

Several of these magnificent vultures were seen cruising around, one over the Phari Plain about 15,000 ft., another in the gorges near Samoda, while a third I noticed sitting on the ground in the Kala Plain. I approached this latter one, mounted, as it seemed to be engaged in a meal, when I got within 150 ft. it flew off. Its meal had consisted of the very dried skinny remains of a Tibetan monk or pilgrim who had evidently died of starvation or exposure some 6 weeks previously. Except for some parched skin and hair in one or two places there remained only the skull and skeleton, not much of a meal even for a kite or hawk far less for a Lämmergeyer!

Columba leuconota gradaria. The Tibetan Snow-Pigeon.

Several of these birds flew down on to the track in front of us from the cliffs between Gautsa and Phari at a height of about 13,600 ft. They were exceedingly tame and seemed to realise that the presence of some ponies on the track meant fresh food for themselves. These birds are very pretty to watch in flight.

Columba rupestris turkestanica. The Blue Hill-Pigeon.

Round most of the villages through which we passed between 13,000 ft. and 15,000 ft. these birds were as common as the blue-rock pigeon round the Indian village. Young corn and dung seemed to be their staple diet.

Corvus coronoides intermedius. The Himalayan Jungle Crow.

Two pairs were seen between Gautsa and Phari quite close to the place where the Tibetan snow-pigeon referred to above were seen.

Corvus corax tibetanus. The Himalayan Raven.

A pair was observed near the rest house at Phari 14,600 ft. and another pair near Tuna about the same height. Several singletons have also been seen along the route beyond. They are enormous birds and comparatively tame and intelligent looking.

Pyrrhocorax pyrrhocorax. The Himalayan Red-billed Chough.

These birds have been seen on practically every march since leaving Yatung. They were breeding at the time and consequently no large flocks were about.

I discovered two nests, one in a loose earth and stone conglomerate cliff about 40 ft. above a bend in the Tumbayung River and another in a rock cliff close to some painted idols at Saugong. Both, which, judging by the noise when the parent birds returned with food, contained well-grown youngsters. No yellow beaked or Alpine chough were seen at all.

Pica pica subsp. ? Magpie.

Large black and white Magpies are common between 13,000 ft. and 13,500 ft. They fly about the cultivated fields and gardens and sit on rocks as there are few trees about. I noticed what I took to be a magpie's nest, very similar to that of the English Magpie, in a small thorn tree about 7 miles from Gyantse.

Upupa epops saturatus. The Tibetan Hoopoe.

Seen at Yatung 10,000 ft. in the Agency Garden. One solitary bird seen feeding on insects at 14,000 ft. in the Kala Plain near a dry ravine in some low hills. Several others seen at Gyantse 13,000 ft. To the ordinary observer they are indistinguishable from the Hoopoes seen in India.

BRITISH TRADE AGENCY,
GYANTSE, TIBET.
June 29, 1935.

R. K. M. BATTYE,
CAPTAIN.

XXVI.—A LARGE MUGGER (*CROCODILUS PALUSTRIS* LESSON) FROM BIKANER—A CORRECTION.

With reference to my letter of the 10th February 1934, which you so kindly published on pages 493-4 of your issue, vol. xxxvii, No. 2, dated the 15th August 1934, I am to state that the heading given to it i.e. 'A large Mugger (*Crocodilus palustris* Lesson) from Bikaner' gives the impression that the animal under reference was shot in Bikaner territory; whilst, that is not the case. It was shot in Kheri, United Provinces. I am sorry, this was not made clear in my letter. But although, this information, I am afraid is rather late, yet I thought you should be informed of the correct place where the Mugger came from.

Furthermore, it was obtained right inland, not far from the foot of the Himalayas and, therefore, the Estuary Crocodile (*C. porosus*) should, of course, not be confused with the specimen in question, though from the scientific point of view and as a matter of general interest measurements of *C. porosus* would also be welcome.

BIKANER.
May 14, 1935.

THE SECRETARY TO THE HEIR-APPARENT OF BIKANER.

XXVII.—THE MUGGER (*CROCODILUS PALUSTRIS* LESSON) FEEDING ON LARGE WATER-BEETLES (*CYBISTER* SP.).

A friend of mine who has shot several Mugger in the Pawai Lake, Salsette Island, has told me that an examination of the stomach contents of one of them, revealed a collection of close on sixty large Water-Beetles (*Cybister* sp. (?)), a couple of Chilwa (*Chela* sp.) and an eel, probably an Eel-pike (*Mastacemblus* sp.). It is curious to find such a large reptile, well able to feed on large fish, etc., subsisting on a diet of beetles!

Bombay Natural History Society,
Bombay.
July 22, 1935.

C. McCANN,
Assistant Curator.

XXVIII.—MALE RAT-SNAKES (*ZAMENIS MUCOSUS* BOULENGER) FIGHTING.

During the months of June and July this year, my neighbours, at Andheri, sent me two couples of Dhamans or Rat-Snakes (*Zamenis mucosus*) which they had shot. The snakes when shot were entwined round one another like a twisted rope, which naturally suggested that they were *in copula.* Examination, by dissection, showed that in both cases the snakes were males. This goes to suggest that the respective couples must have been fighting at the time they were shot. There are many records of snakes seen in the manner described and in most cases, if not all, that attitude has been ascribed to copulation. However, as is well known, snakes usually exhibit no obvious external sexual differences and only a careful examination aided by dissection will reveal the sex definitely.

The combatants in these two instances were of almost equal size. What the fights were over it is difficult to say; but, as the breeding season was over these snakes may have been fighting for territorial supremacy.

One of the snakes contained a semi-digested bloodsucker (*Calotes versicolor*), the stomachs of the others were more or less empty.

Bombay Natural History Society,
Bombay.
July 16, 1935.

C. McCANN,
Assistant Curator.

XXIX.—PRECOCITY IN YOUNG BULL-FROGS (*RANA TIGRINA* DAUD.).

Soon after the break of the monsoon Bull-Frogs appeared in full force as usual. Breeding was at its height and numerous individuals both large and small were to be seen *in amplexu* gathered round the pools and puddles. Curiously enough the frogs sorted themselves out 'according to size'; the large males and females measuring 4-5 inches and over, occupying different pools to those of smaller size (between 2-3½ inches). The males, both large and small were all in breeding dress—pale lemon yellow, but the intensity of colour was decidedly more pronounced in the larger males. The females were the usual sombre brown. Before proceeding I must correct my previous statement in my article 'Notes on Indian Batrachians' (*J.B.N.H.S.*, xxxvi, p. 159) in which I stated, 'The females and young males are the usual sombre brown. . . .' As stated above young males are also lemon yellow when they emerge from aestivation.

In order to examine the condition of the genitals I caught and dissected several pairs that were *in amplexu*. The large males and females had the genitals well developed: the ovaries were full of eggs, and the testes decidedly enlarged. But in the smaller frogs the ovaries and testes were immature. This indicates that the sexual urge is apparently equally as strong in immature frogs at it is with so many other immature animals.

Further, it must be noted that the young males also croaked like their elders. The vocal sacs were also coloured blue and the callosities on the inner fingers were also well developed.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY.
July 17, 1935.

C. McCANN,
Assistant Curator.

XXX.—ANTS ATTACKING RUBBER GOODS.

I have on several occasions been forcibly impressed by the strong attraction that rubber has for the small and very common Red House Ant. Their persistence is a source of worry and nuisance to the house-keeper in India, but when they lose their appetite for crumbs and the like, and one finds them, when one opens one's Onoto Ink Pencil, devouring the small rubber pad inside the cap, or inside the filler bulb, or again on top of one's soda-water bottles eating the red rubber washer round the marble and yet again taking great delight in honeycombing the soles of one's crepe-soled shoes, they become rather more than a long suffered curse of this country.

I have not come across any reference to this liking for rubber with regard to this ant in the world of Natural History. Whether they actually eat the rubber I have been unable to ascertain, but they are certainly very successful in reducing it to powder. They seem to prefer crepe and red rubber to vulcanised rubber and that used for erasers.

It would be interesting to know if any other readers of the *Journal* have observed this rubber 'eating' propensity.

NADUAR ESTATE,
VALPARAI P.O.,
SOUTH INDIA.
June 11, 1935.

R. N. CHAMPION-JONES.

XXXI.—OCCURRENCE OF THE BEETLE *STERNOCERA CHRYSIS* IN WAZIRISTAN.

In November 1932, I sent you some *Buprestid* beetles from South Waziristan, and in your letter of 18-11-32, you stated that you were sending them to England for identification. Were they ever identified?

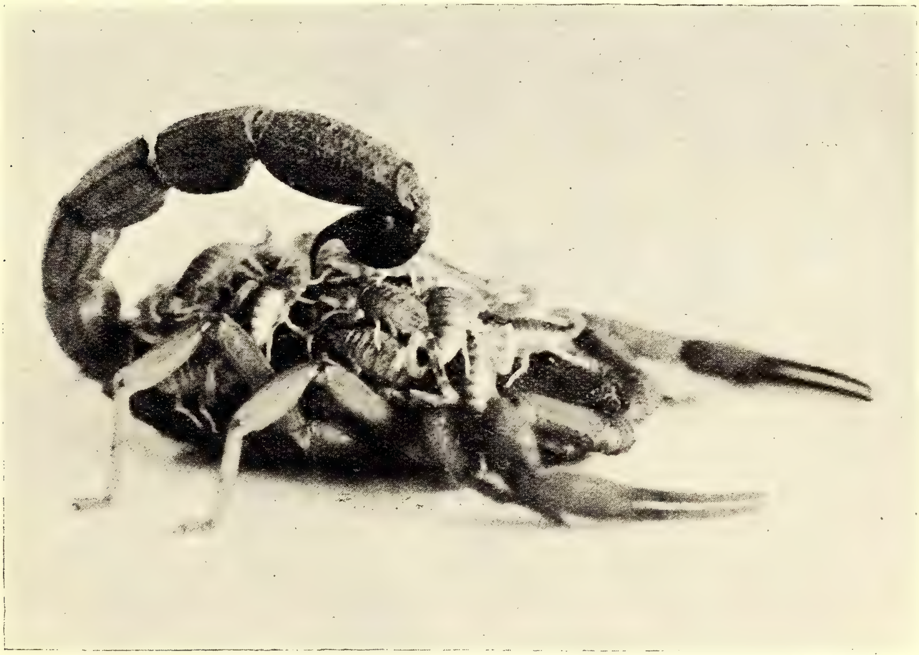
Royal Garhwal Rifles,
Lansdowne, U.P.
April 7, 1935.

D. G. LOWNDES,
Captain.

[The beetles were identified by the British Museum as *Sternocera chrysis.* This is a common species which has been recorded so far only from South India and Ceylon. Its discovery in Waziristan is interesting.—Eds.].

XXXII.—PARENTAL CARE IN SCORPIONS.

A correspondent, in the last number of the *Journal* (15 April, 1935) asks 'Do young scorpions eat their parent?'



A female scorpion (*Buthus* sp.) mothering her young.
Photo by G. K. Powle.

I should think that it is quite impossible to perform this act of cannibalism. For a considerable time, after birth, young scorpions remain soft bodied and of a milk-white tint. The hardening of the dermal tissues is very gradual and slow, and their small chelae could make no impression upon the parent's coat-of-mail.

On the other hand, I have kept a mother scorpion and her brood in captivity and—although provided with other insect food—have seen her pick off and devour her babies, one by one, until none were left. I do not suppose that this is a natural habit; but it possibly objected to the publicity of repeated inspection.

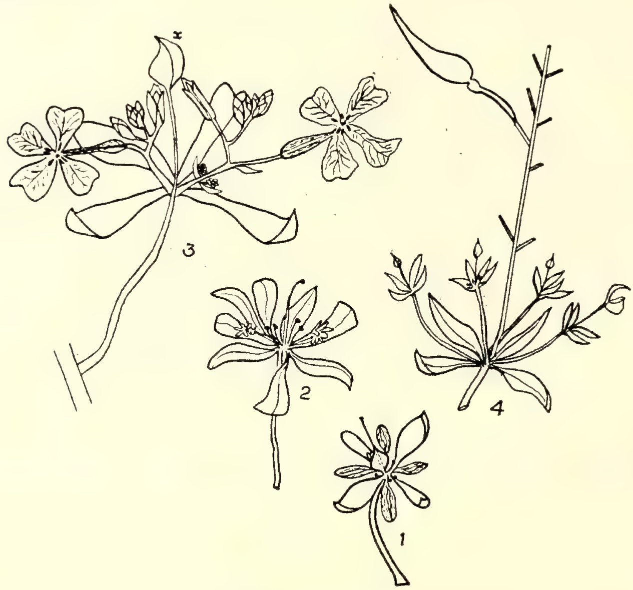
My captive scorpions were thirsty creatures. I used to give them water to drink through a pen-filler. It was amusing to see how soon they came to recognise this instrument. They would reach up, seize the nozzle in their chelae, and apply it to their mouths. They would, in the same way, enjoy an occasional drink of milk.

WAY'S END, BEECH AVENUE,
CAMBERLEY, SURREY.
May 27, 1935.

E. ERNEST GREEN.

XXXIII.—ABNORMAL FLOWERS OF THE RADISH (*RAPHANUS SATIVUS* LINN.).

The abnormalities described below were noted in a plant, produced by one of the seeds sown by me, in a plot in the Training College, Agra. This plant had a peculiar bushy appearance on account of several vegetative and reproductive branches coming out from the base. These branches curve down and rise upward bearing a large number of abnormal flowers described under two main types:—



Abnormal flowers of *R. sativus.*

Type A. (Fig. 1): The four sepals are thicker and broader than those of the normal flowers and have acute apices. Moreover, one pair of sepals is larger than the other. Similar is the case with the four petals which are sometimes sepaloid (green) and twice as big as sepals. They can be recognised by their obovate clawed shape and crumpled condition. All the stamens of the tetradynamous androecium are sterile. In place of the gynaecium there arises a peculiar looking inflorescence enclosed in a membranous sheath (marked x in Fig. 3) or an ordinary inflorescence with fertile normal flowers. The former consists of normal fertile flowers, or sterile flowers, or abnormal flowers. Sometimes, there is only one abnormal flower inside the sheath.

Around the central inflorescence (x) arise additional (1 to 4) inflorescences and one or more abnormal flowers (Fig. 4.). In some cases, one or two bracteate abnormal flowers arise secondarily on the pedicel of an abnormal flower.

Type B (Fig. 2): Some abnormal flowers have rosy petals and out of the six stamens the two lateral ones are replaced by two inflorescences of fertile flowers. Such a flower is bisexual and produces a fruit which is on an average only 2.5 in. long and contains 6-10 big but thin seeds. Such flowers occur in inflorescences which are not typically racemose, as, sometimes, two flowers are situated opposite to each other at a node.

Fruits produced from normal flowers of this plant are unusually small (1.5 in. long and .4 in. in diameter) and produce only one or two seeds.

I am thankful to Mr. B. L. Gupta of the Agra College for assistance in the interpretation of the abnormalities and to Mr. L. P. Gupta of the Training College, Agra, for permission to keep the plants under observation and send this note to the press.

Teachers' Training College,
Agra.
April 18, 1935.

AGHA MOHAMMAD.

PROCEEDINGS OF THE MEETING HELD ON 1st. OCTOBER 1935.

A meeting of Members of the Bombay Natural History Society and their friends was held at the Prince of Wales' Museum on Tuesday the 1st of October at 6-15 p.m. The Hon'ble Mr. Justice Barlee presided.

Mr. P. M. D. Sanderson, the Honorary Secretary, gave a short account of the present activities of the Society and announced the election of 12 new members since the last meeting held in August, making 48 since January last, and bringing the total to approximately 1,200.

Mr. J. B. Rowntree, I.F.S., Nowgong, Assam; Mr. J. W. Houlton, I.C.S., London; Mr. E. K. Krishnan, Mangalore; The Officers' Mess, Royal Indian Navy, Bombay; Capt. W. P. H. Gorringe, Ambala, Punjab; Mr. C. E. C. Chandler, Barahapjan, Upper Assam; Mr. J. D. Jenkins, Poona; The Librarian, Chulalongkorn University Library, Bangkok; Major C. G. Toogood, D.S.O., Military Secretary to H. E. The Governor, Bombay; Maharaj Kumar Shree Chandrabhanusinhji of Wankaner State, Wankaner, Kathiawar; Lt.-Col. M. D. Vigors, D.S.O., M.C., Saugor, C.P. and Mr. Shanker Wamanrao Muzumdar, Bombay.

He also referred to an expedition of Mr. McCann, the Assistant Curator, and two other members of the staff. Due to the kindness of H. H. the Maharao of Kutch and the assistance of Mr. Steer-Webster, Technical Adviser, they were now trying to procure photographs and paintings of the nesting sites of flamingoes which were breeding about a hundred miles out in the great Rann of Kutch. It was hoped that the results of this expedition would be on view before very long in the Prince of Wales' Museum.

LECTURE BY RIGHT REV. R. D. ACLAND.

Specimens on Table.

The Bishop then gave his lecture on the wild flowers of Bombay. Although he spoke for only an hour, he covered an immense amount of ground and in spite of the unavoidable technicalities of the subject, he contrived to make it so interesting that even the veriest beginner could understand. In front of him, on a long table, was spread a large number of wild flowers which he himself had collected that day.

As each specimen was handed to members, he described in vivid and attractive manner how it could be identified. There were a number of books on the table, including Nairne's *Flowering Plants of Western India*,—still a wonderful help to the botanist, although it is now 40 years since it was published. There were also a small magnifying glass with a hinged stand, a knife etc. on the table, but the Bishop said 'all that is required to follow this fascinating study successfully is the intelligence of a girl of 12 and the patience and persistency of a boy of 15'.

It was a pity that the meeting on this subject could not have been held earlier, say in June, when so many more plants were in flower. However, in spite of this, the obvious keenness of the lecturer, which was soon shared by his hearers, and his wide knowledge of botany made the meeting one of the most interesting the Society has had.

The thanks of the Society were wittily expressed by Mr. Justice Barlee.

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MR. P. M. D. SANDERSON FOR THE BOMBAY NATURAL HISTORY SOCIETY, BOMBAY

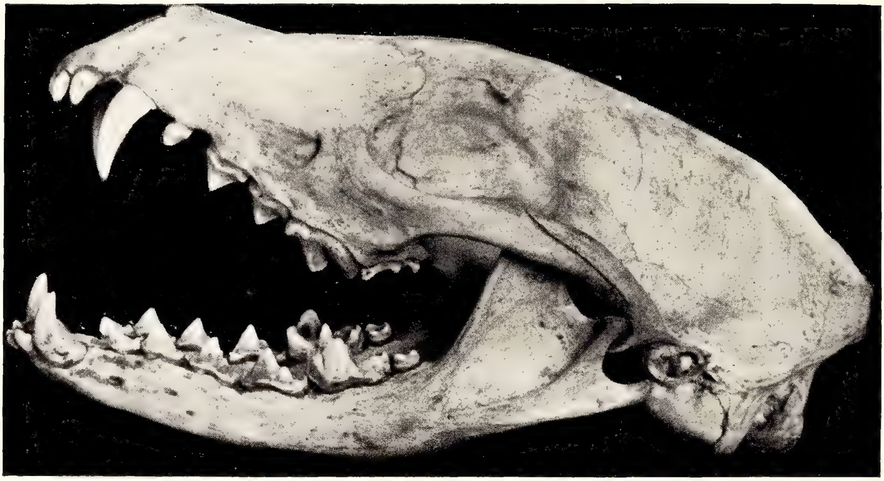
Continued from page 188 of Vol. XXXVII, No. 4
of the Journal of the Bombay Natural History Society.

THE WILD ANIMALS OF THE INDIAN EMPIRE

AND THE

Problem of their Preservation

Part IV.



Skull of the Large Civet (*Viverra zibetha* Linn.).

THE WILD ANIMALS OF THE INDIAN EMPIRE.

PART IV.

CARNIVORA OR BEASTS OF PREY—(*continued*).

FAMILY: II. *VIVERRIDAE*: CIVETS, GENETS, ETC.

The family includes the True Civets and their numerous relatives—Genets, Palm Civets, Lisangs, Bear Cats. They form a diverse assemblage of animals, which in certain characters connected with the structure of the skull and the anatomy of the body display some affinity to the Cats (*Felidæ*) and, they are generally regarded as their next of kin. Nevertheless the Civets do not reveal that uniformity in build which is so distinctive of the Cat Tribe. Marked structural differences among them make it difficult to provide a general definition which would distinguish them as a tribe from other beasts of prey. They differ from cats in many ways. None of the civets attain the size of the great cats, they are all comparatively small creatures, long in body, short in limb with elongated heads and pointed muzzles. We have seen how the teeth of cats show a marked adaptation to a purely carnivorous diet; how specialization to this end is revealed in a shortening and strengthening of the jaws, in a marked development of the canine teeth and in a reduction in the number of molar teeth, whose blade like crowns make them perfect cutting instruments. The jaws of civets on the other hand show no reduction in the length and carry almost the full number of teeth of a typical carnivore. They have a larger number of cheek teeth than any of the existing cats.

All the Indian members of the tribe have four premolar teeth on each side of the upper and lower jaws and one or more true molars. The canine teeth are more feeble than those of cats, the flesh-tooth is less trenchant and more tubercular in character. The long pointed cusps of the cheek teeth of some of the *Viverridae* recall the dentition of an insectivorous animal; while the molars of others, like the Palm Civets and the Bear Cat, which feed largely on fruit, have almost lost their carnivorous character. The teeth of civets help to show how, within the limits of a single family, while the family characters of the dentition may be retained, the form and size of the teeth may vary in accordance with the habits of life and the food of the individual species.

In the structure of the feet again the civets display a lesser degree of specialization than the cats. The number of toes both in the fore and hind feet is generally five. This is seen in all the Indian members of the tribe, whereas cats have five toes in the fore foot and four in the hind. The claws vary in retractability. In some forms, as in the True Civets (*Viverra*), some of the claws of the fore feet are as retractile and as well protected by sheaths as in many species of cats. In other forms this character is less apparent. Yet another point of distinction in civets is the entire absence of the sharp pointed conical papillae which convert a cat's tongue into a rasp.

It will be seen that while the civets display some affinity to the cats; their general equipment as beasts of prey places them on a lower level. They display in their build and their armament of teeth and claws a lower degree of adaptation to carnivorous habits of life.

No representative of the family exists in America or Australia. All its members are confined to the warmer parts of the Old World, chiefly to Africa, Madagascar and South-Eastern Asia. One species is found in Southern Europe.

Pocock in his classification of the family recognises a number of gropus or sub-families. The following occur in our area:

Sub-family *Viverrinae*: True Civets.
,, *Paradoxurinae*: Palm Civets.
,, *Prionodontinae*: Tiger Civets or Lisangs.
,, *Arctogalidinae*: Small Toothed Palm Civets.
,, *Hemigalinae*: Banded Civets.

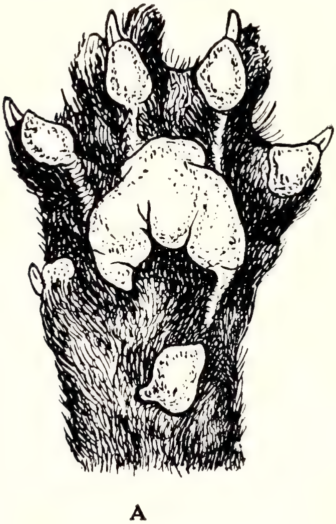


Fig. 1.—Feet of *Viverra zibetha*, a true civet of terrestrial habits, showing hairy soles and reduction of pads. (A, Left forefoot; B, Left hindfoot.)

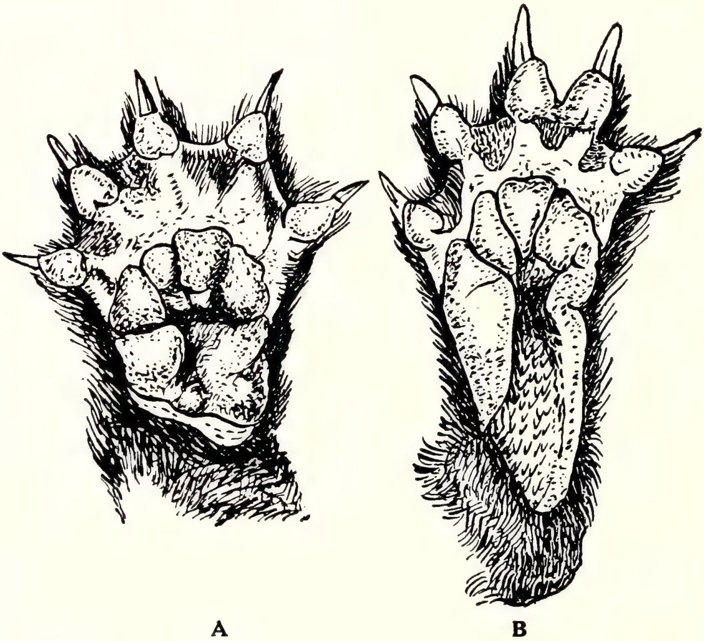


Fig. 2.—Feet of *Paguma larvata*, one of the arboreal Palm Civets showing comparatively naked soles and greater development of the pads for grasping the branches of trees. (A, Left forefoot; B, Left hindfoot.)

After Pocock (*Proc. Zool. Soc. Lond.*).

Sub-family: 1. *VIVERRINAE.*

True Civets.

The Civet tribe (*Viverridae*) has been differently classified by various naturalists. Pocock in his recent classification limits the sub-family *Viverrinae*, which includes the true or typical Civets, to five genera. They are as follows: The Large Oriental Civets of the genus *Viverra;* a second genus *Moschothera*, formed to distinguish two large civets, one found in Malabar, the other in Lower Burma and the adjoining Malay countries; the small civets of the genus *Viverricula;* and finally the two African genera *Civettictis* and *Genetta.*

Apart from the Genets which are found also in Southern Europe, the True Civets are confined entirely to the Oriental and Ethiopian region.

The *Viverrinae* or True Civets form a compact little group, distinguished from the Palm Civets or Paradoxures by the form of their feet and the more elaborate structure of their scent pouches. In these True Civets, the plantar or central pad under the fore foot is reduced in size and, compared with the Palm Civets, there is an even greater reduction in the size of the carpal pad (a small pad in the region of the wrist). On the hind foot the corresponding pad is almost or entirely suppressed. Further in the True Civets the whole under-surface of the foot with the exception of the pads is almost completely covered with hair. The growth of hair under the feet, the reduction or suppression of the carpal and plantar pads is variable in different members of the group. But on the whole these characters, which are more or less marked in True Civets, indicate a greater adaptation in these animals to a terrestrial life. Palm Civets, on the other hand, are mainly tree-dwelling animals. Their naked soles and well developed pads fit them in a greater degree for an arboreal existence.

Like cats, true civets walk upon their toes, and their feet bear a close superficial resemblance to the digitigrade feet of cats. This resemblance is seen particularly in the reduction of the carpal pads and in the hairiness of the under foot. The resemblance is carried further in certain members of the group such as the Small Civets (*Viverricula*) whose feet are perhaps the most feline in character. In these little civets, as in cats, the hallux and pollex, or those digits which correspond to the thumb and big toe, are placed high up on the foot and at some distance from the ther digits. Again in the large civets of the genus *Viverra* some of the claws of the fore feet are protected with sheaths of hairy skin. These claws are therefore as retractile as those of many species of cats. As we have already seen, the extent to which different species of cats can sheath their claws varies considerably.

The true civets have well developed scent glands. They produce the well known perfume which gives the name to the tribe. The word 'civet' is derived from the Arabic term *zabat*, a name used for the scent derived from the glands of these animals. The structure of these glands varies in different members of the group. It may even differ to some extent in males and females of the same species. These glands generally take the form of two elongate eminences covered internally and externally with hair. They are found in both sexes and lie just in front of the testes in the male and in a corresponding position in the female. In Genets the two lobes of this gland lie closely apposed. Their line of contact is marked with a Y-shaped groove. When pulled apart the space between the glands will be found to consist of three compartments separated by folds of skin. The secretion of the glands exudes into these compartments from clusters of tiny pores in the lateral walls. In the large Oriental Civets (*Viverra*), the glandular space between the lobes is not divided into compartments. Nor are the two lobes of the gland closely apposed through their entire length. In their posterior half towards the scrotum the two glands are somewhat widely separated, but anteriorly their inner margins fuse together to form the roof of a deep pouch, which constitutes a large storage chamber for the secretion of the glands. In a male of the large civet (*V. zibetha*) examined by Pocock the naked skin between the testes was found to be glandular as also a thick fold of integument which almost completely encircles the anus. The secretion from the gland surrounding the anus has however a very different and extremely offensive odour. The secretion from the perfume gland is used both for perfumery and for medicinal purposes. In India it is held to have valuable medicinal and aphrodisiac properties. The secretion contains free ammonia, resin, fat, and a volatile oil to which its ordoriferous properties are due. It is a strong smelling perfume and requires a highly trained nose for its appreciation. The so-called 'civet' perfume of commerce which is imported into India, comes from America. It is not obtained from civets, but is taken from the Beaver.

In India the secretion is collected from the Large Indian Civet (*V. zibetha*) and to a greater extent from the Small Civet (*V. malaccensis*). It is much sought after by some of the Brahmins of Malabar and as much as Rs. 10 per tola is paid for the pure essence. The 'civet' obtainable in the bazaars is much adulterated with butter and oil to increase its weight. The best prices are paid for the entire pouch cut from a freshly killed animal. The usual method of collecting 'civet' is to scrape it out of the animal's scent pouch with a wooden spoon. It is recorded that there was an establishment once maintained at the expense of the Travancore Government in which civets were reared for the purpose of collecting the perfume. Numbers of Small Indian Civets are still kept at Kolar in East Mysore for the same purpose. 'Civet' is very largely produced in Java from the Javanese race of the animal (*V. indica rasse*), where it is used very considerably for flavouring tobacco smoked by the Javanese.

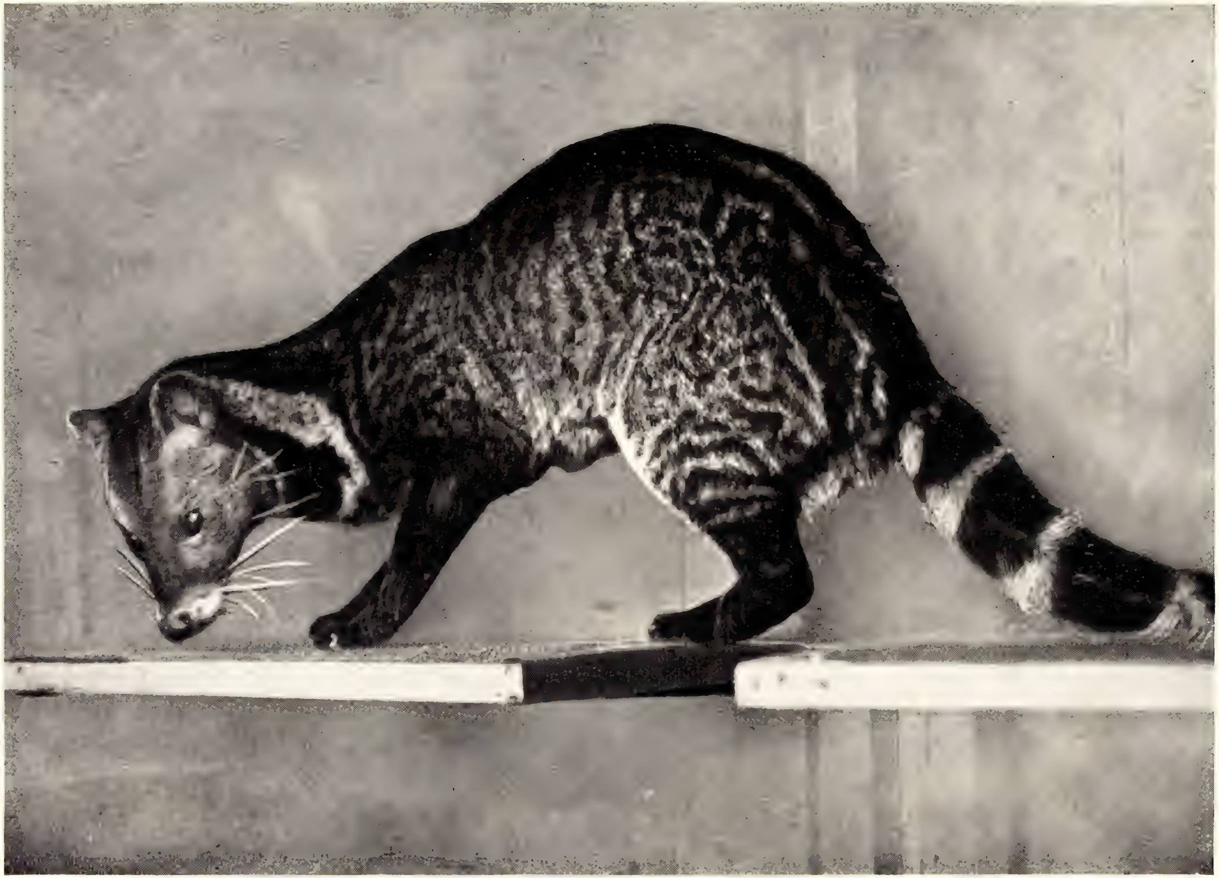


Photo by W. S. Berridge.

The Large Indian Civet (*Viverra zibetha* Linn.).

THE LARGE INDIAN CIVET (*VIVERRA ZIBETHA* LINN.).

This Large Civet is found from North India and Northern China through Burma, Siam and the Malay Peninsula.

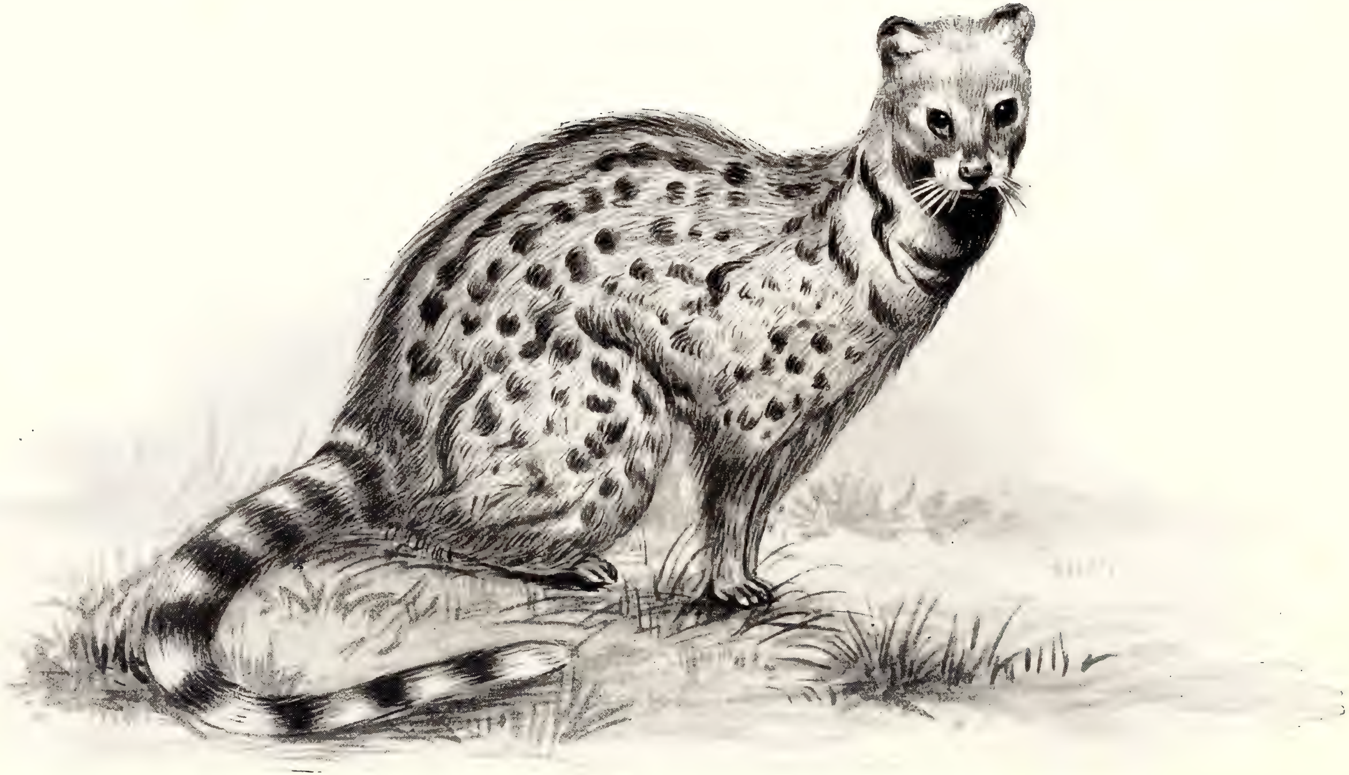
It is a sturdily built animal with a long head, long flattened body, stumpy legs and small rounded feet—a build, typical of the true civets. An adult animal measures nearly 4 feet in length: its thick tapering tail is more than half as long as the head and body.

The general colouration is a dark hoary grey, frequently washed yellowish or brown. An erectile crest of long deep black hairs runs down the middle of the back. The crest is distinctive and differentiates the Large Civets from the Small Civets of the genus *Viverricula*. The crest forms a heavy black stripe from the shoulders to the first ring of the tail. The tail is completely ringed with six broad black bands. Pale bands form an edging to the black dorsal crest. There are several dark bands on the chest and shoulders. The sides of the body are either plain or have more or less distinct markings. Such markings may be obscured or obliterated in the longer and more luxuriant winter coat. A seasonal change of coat takes place between May and July. It is more marked in animals inhabiting the northern areas of the civets range.

The luxuriance or otherwise of the winter coat and the prominence of pattern are some of the characters which are used to differentiate between the various races of this animal. The typical race (*V. z. zibetha*) is found in Nepal, Sikkim and Northern Bengal. Compared with the Chinese race (*V. z. ashtoni*), it has a moderately long winter coat. The race from Burma and Assam is *V. z. picta*. It is said to be distinguishable by the persistence of pattern even in the winter coat. A third race, *V. z. pruinosa* is found in Tenasserim and the Malay Peninsula. It is distinguished from the more northern races by the shortness of the coat and distinctness of its pattern in the winter months, seasonal variation in coat in this race is very slight. A fourth race *V. z. surdaster* is described form Indo-China.

The Large Indian Civet is a solitary creature sheltering in bushes, thick grass or heavy scrub jungle by day, and coming out to hunt by night. It preys on small animals and birds and may be very destructive to poultry. Like most carnivores, it feeds on anything worth killing and its food may include, snakes, frogs, fishes, crabs and even insects. It is not exclusively carnivorous, and feeds equally on fruits and certain roots. It takes readily to water. It breeds in May and June, and usually has four or five young. The scent glands, are large, measuring, when dissected out, about 2.5 inches in length and 1.5 in. in breadth. Dogs are said to be greatly excited by the scent of this civet and will leave that of any other animal for it.

In addition to the Large Indian Civet (*V. zibetha*), two other large species are found in our area. They are the Large Malabar Civet (*Moschothera civettina*) found in Travancore and Cochin, and the Burmese Civet (*M. megaspila*) which is found in Southern Burma, Siam, Annam, Cochin China and the Malay Peninsula. These two civets, now regarded as representing a distinct genus, differ from the Large Civets of the genus *Viverra* by the absence of sheaths to the claws of the fore feet, and by the comparatively hairless condition of the skin between the pads of the feet. Both species are very rare. The general colouration and markings are very similar to the Large Indian Civet, except that the white bands on the tail do not completely encircle it. The general habit of these civets are similar to those of the Large Indian Civet.



Del.

The Small Indian Civet (*Viverricula indica* Geoffroy).

THE SMALL INDIAN CIVET (*VIVERRICULA INDICA*, GEOFFROY).

The Small Civet is found in the Peninsula of India, from Sind, the Punjab and the foot hills of the Himalayas, southwards to Ceylon and eastwards through Burma into Southern China, Indo-China, Annam, Burma, Malacca and Java.

The absence of a dorsal crest of long black hairs will serve to distinguish this civet from the large civets of the genus *Viverra*. It is a much smaller animal. A well grown adult male is a slightly over 3 feet in entire length, the tail being a little over a foot long. It scales from 6-8 lbs.

The general colouration of a typical specimen from Southern India varies from brownish or olivaceous grey to light grey. There are longitudinal dark stripes and rows of spots along the body, a stripe down each side of the neck and frequently one across the throat. The tail is ringed with grey and brown. The under-fur is brownish or greyish and varies in density. Before the moult the coat becomes hard, brittle and lustreless. The change to the fuller winter coat takes place after September.

Various Indian races of this civet are now recognised. The distinctions between these forms are based on colouration, size, cranial and other characters. The typical race (*V. indica indica*) is said to inhabit Southern India from the Western Ghats across the peninsula to the Eastern Ghats as far as the Chilka lake in Orissa. A second race, *V. i. bengalensis* is apparently found in the central portion of India, south of the Ganges, from Calcutta to Gujerat and possibly in Sind. More or less distinct races are said to occur also in the following areas: *V. i. deserti* (Rajputana); *V. i. wellsi* (Punjab and the United Provinces); *V. i. baptistae* (from Bhutan, Upper Bengal, Assam); *V. i. thai* (from Siam and Indo-China and probably also in Upper Burma); *V. i. klossi* (in the Malay Peninsula and apparently in Lower Burma); *V. i. mayori* (in Ceylon). A detailed description of these races will be found in Pocock's monograph on the 'Civet Cats of Asia' published in the *Journal of the Bombay Natural History Society* (vol. xxxvi, p. 647).

The Small Indian Civet is a shy seclusive animal, almost entirely nocturnal in its habits. It lives in holes in the ground or under rocks or thick bushes. It is frequently found in the neighbourhood of villages or even within the large towns. It climbs well and will scale a vertical tree trunk with ease. It is more arboreal in habit than is usual with the true civets. Though it kills poultry when opportunity offers, like other civets, it prefers preying on rats, lizards, small birds and insects. It feeds on fruit and is fond of the berries of the Ber (*Zizyphus jujuba*). It is easily tamed. The species is frequently kept under domestication for collecting the secretion of its scent glands.

Sub-family: 2. *PARADOXURINAE.*

Palm Civets.

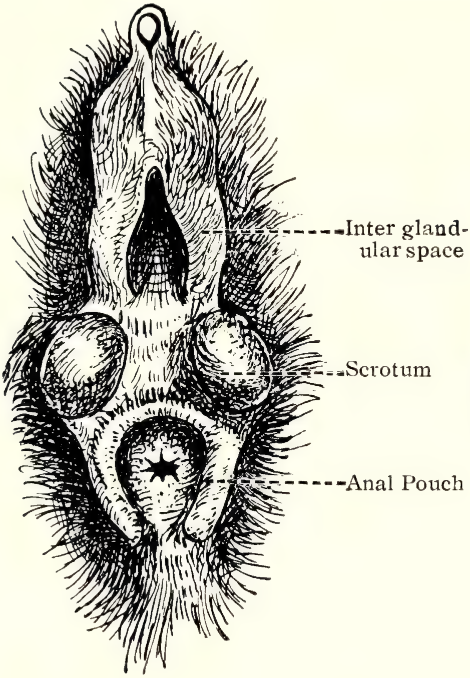
The Civet Tribe (*Viverridae*) contains a second group of animals —the *Paradoxurinae* of which the Palm Civets or Toddy Cats are the dominant members. This group also includes the Binturong or Bear Cat (*Arctictis*) and a rare genus of civet from the Celebes (*Macrogalida*).

External characters which distinguish the Palm Civets from the true civets are seen in the form of the limbs. The Palm Civets are short-legged animals. Unlike true civets, they walk to a greater extent upon the soles of their feet. Again in distinction to the true civets, the soles of the feet, both in the fore and hind limbs, are almost completely naked. Further the greater development of the pads which lie behind the central or plantar pad of the foot indicates a more perfect adaptation in these animals to an arboreal existence than is revealed in the true civets.

The perfume glands are also very different from those of the true civets. The plan of their structure is much less elaborate. The secretion of the glands is discharged into a slight fold of skin instead of a deep pouch. There is a large area of naked skin, corresponding to the glands in front of the scrotum in the males and around the genito-urinary orifice in the females. The secretion from the anal gland in some forms is singularly fetid and can be discharged under stress of fear or excitement. The teeth vary very much in development and are very large in some species while they are small in others. They are suited to the mastication of both animal and vegetable food.

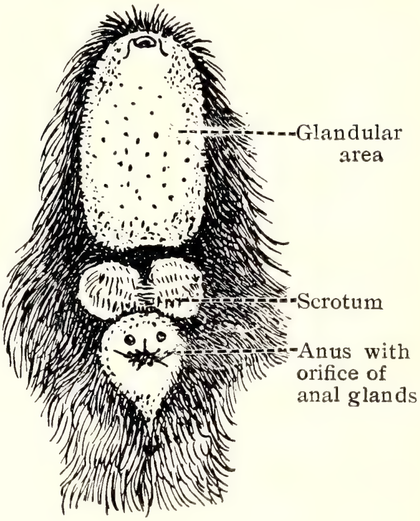
The Palm Civets are comprised in two genera, *Paradoxurus* and *Paguma*, which are distinguished by characters of the skull. These animals are exclusively Asiatic, ranging from India, Burma, through the Malayan Region to the South of China. They also occur in the Philippines, Celebes and Formosa.

PERFUME AND ANAL GLANDS OF CIVETS.


Inter glandular space
Scrotum
Anal Pouch

A

A.—Inferior view of the anal glandular area of the Large Civet *Viverra zibetha* (male).


Glandular area
Scrotum
Anus with orifice of anal glands

B

B.—Inferior view of anal glandular area of the Common Palm Civet *Paradoxurus hermaphroditus* (male).

After Pocock (*Proc. Zool. Soc. Lond.*).

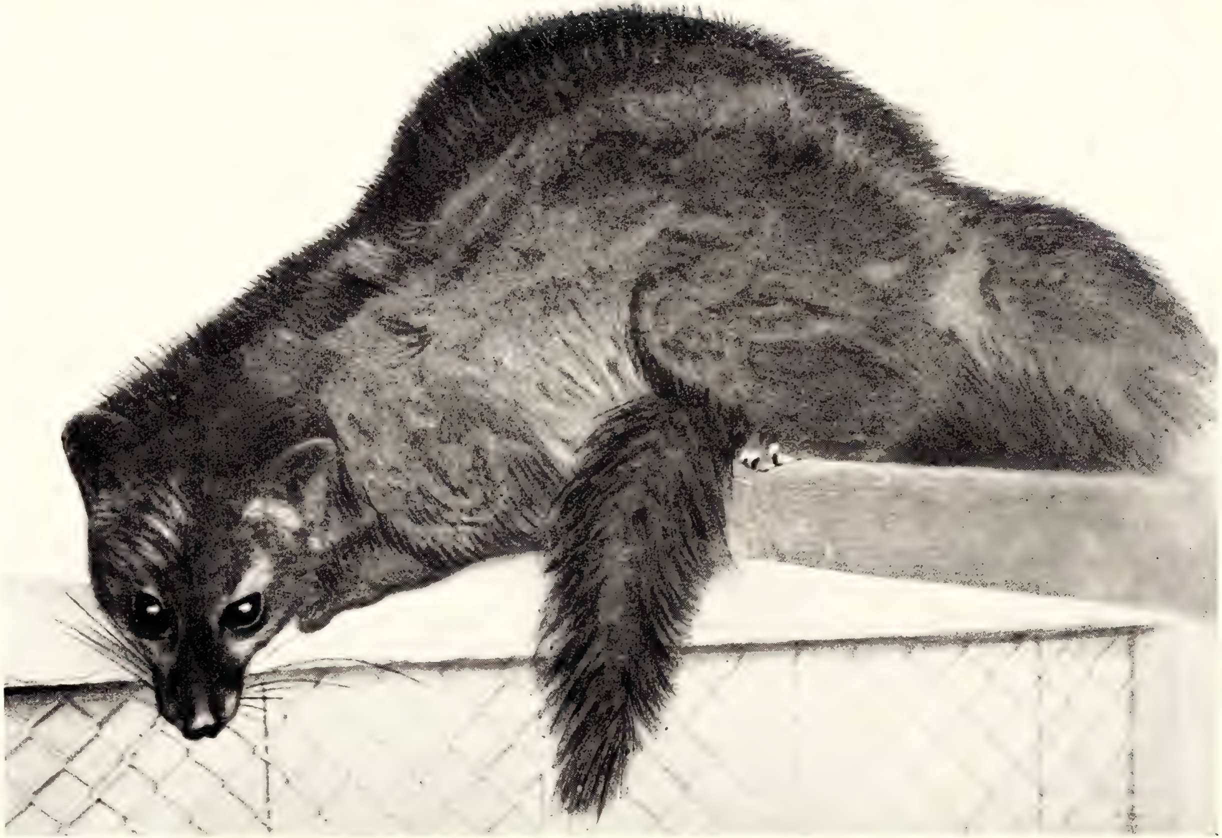


Photo by *W. S. Berridge.*

The Common Palm Civet (*Paradoxurus hermaphroditus* Gray).

THE COMMON PALM CIVET OR TODDY CAT (*PARADOXURUS HERMAPHRODITUS* GRAY).

The best known of all the Palm Civets is the Common Palm Civet or Toddy Cat (*Paradoxurus hermaphroditus*). It is found in Ceylon and practically over the whole of India from the Himalayas to Cape Comorin. Eastwards its range extends through Assam and Burma to South China and the Malay countries and Islands as far east as the Philippines, Borneo and the Moluccas. Blanford in his *Mammals of India* applied the name *niger*, to the Indian Palm Civet and the name *hermaphroditus* to the Malayan species. Pocock in his recent review of the species recognises but one species as inhabiting India and South-Eastern Asia, and considers the name *hermaphroditus* as more correctly applicable to it.

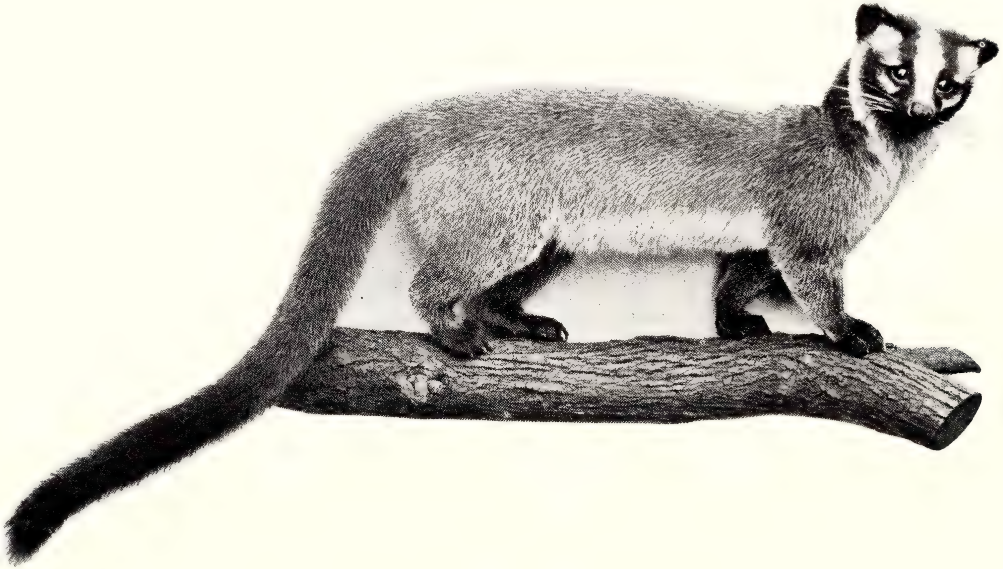
The tail of the Common Palm Civet is nearly or quite as long as its head and body which may be slightly over 2 feet in length. Its weight averages from 6 to 9 lbs.

The general colour of its coarse, somewhat ragged fur is black, blackish or brownish grey, the shorter grey or brown under fur of the coat, when present, is partly or wholly concealed by overlying longer and darker hairs. These longer hairs are generally paler towards the tips and as such hardly distinguishable in colour from the pale under wool. But in certain areas of the body the long hairs of the coat are dark throughout. These dark areas by contrast with the paler surrounding hair tend to suggest a pattern of black stripes on the back. A similar suggestion of spots is seen in the flanks and sometimes on the thighs and shoulders. This pattern is not always obvious. It is generally most prominent in an animal which has freshly moulted its hair. The season of coat change varies in different localities. Generally, the civets are in poor coat between May and October, and in full coat between December and March. The change of coat naturally makes a profound change in the general appearance of the animal. It is more marked in some localities and less appreciable in others. The luxuriance of the coat, the extent of development of the under fur, the obviousness or otherwise of the pattern, the comparative size of the teeth, minor distinctions in the skull have been used as characters to distinguish between the numerous races of the civet. The typical form is said to occur in Central and Southern India and Ceylon.

The Civet is generally known in India as the Toddy Cat, because of its habit of climbing Palmyra palms to drink the toddy which flows into the jars hung up by the toddy-drawers. In Java the species is known as the 'Coffee Cat', owing to its habit of collecting in numbers round coffee plantations to feed on the ripe berries. The seeds of the berries are passed out whole by the animal, generally on a pathway or against the stumps of trees. They are subsequently collected by the coffee gatherers when the regular picking is over. Palm Civets appear to be largely frugivorous, though like other civets, they feed on small animals, birds and insects. They are arboreal and rest by day concealed among the branches of a tree or curled up in a hole in the trunk. They are common round villages and have even been found in the centre of towns and cities. They usually select to live in the rafters of houses, or in drains and come out at night in quest for food. When taken young this civet is easily tamed and in confinement eats cooked food of almost any kind. The animal probably breeds throughout the year. The majority have their young after the rains, during the cold weather, 4-6 young are born at a time.

A second species of Palm Civet, the Brown Palm Civet (*P. jerdoni*), is found in the hill ranges of Southern India. It is distinguishable from the Common Palm Civet by its rich deep brown colouring, the back and flanks are somewhat grizzled. The vibrissae (whiskers) are dark brown. Unlike the Common Palm Civet the hair on the neck of this civet is reversed and its growth is directed forwards towards the head. Its habits are similar to the Common Palm Civet.

PLATE LIX



The Chinese Palm Civet (*Paguma larvata* Gray).

THE CHINESE PALM CIVET (*PAGUMA LARVATA* GRAY).

The genus *Paguma* is now considered to include but two species of Palm Civet, the Tibetan Palm Civet (*P. lanigera*), about which little is known, and the Chinese Palm Civet (*P. larvata*). The Himalayan Palm Civet (*P. grayi*) and the Sumatran Palm Civet (*P. leucomystax*) are now looked upon merely as racial forms of the Chinese Palm Civet whose range extends from Southern China to the Himalayas as far west as Kashmir and reaches southwards through Burma to the Andaman Islands, Sumatra and Borneo.

The Chinese Palm Civet (*P. larvata*) is distinguished from the Common Palm Civet (*Paradoxurus*) by certain characters of the skull. Its skull is more robust, has a broader waist, and the bony palate extends well beyond the molar teeth of the upper jaw. From differences in the muscularity of the skull and the less trenchant character of its teeth it is inferred that *Paguma* is less predatory and more of a vegetable feeder than *Paradoxurus*.

Externally, the Chinese Palm Civet may be distinguished by its white whiskers and by the entire absence of any suggestion of spots or stripes on its body. The general colouring ranges from grey to tawny. The lower parts are paler or whitish. The under fur is brownish, grey or dusky. Markings more or less obvious are present on the face. More or less distinctive is a fringe of white hairs in front of the ears which projects over the cheeks. A line running down the middle from the forehead to the nose, and a blotch or spot below each eye usually stand out as markings from a more conspicuous intermingling of white hairs. The whiskers are mostly white. In a male and female of this species captured in Almora District, United Provinces, the male appeared to be altogether darker in general colouration. Its facial markings were less pronounced—more grizzled—the darker hairs predominating. The facial markings of the female were on the other hand more distinct and stood out more clearly from a predominance of white hairs in the markings. How far this differentiation in the colouring of the sexes is prevalent remains to be ascertained. There is much individual variation in the facial markings. They may be well emphasised or indistinct, the nape of the neck may be pale or dark brown or black or conspicuously speckled with grey. Variation is also seen in the development of the fringe of hairs in front of the ears and in the length of the winter coat. These variations may be to some extent correlated with certain areas of the animals' distribution and are used to distinguish various geographical races of this civet. Six races are recognised as occurring in the Indian Empire. Descriptions indicating the distinctive characters of these races will be found in the *Journal of the Bombay Natural History Society* (vol. xxxvii, p. 326).

As regards size, the Himalayan forms stand midway between the small Chinese race and the large Malayan races. An adult male from Kumaon measured a little short of 4 ft. 2 in. in total length of which 2 ft. was tail. Its weight was 11½ lbs.

The habits of this Palm Civet are very similar to those of the Common Palm Civet. It is perhaps more frugivorous—though, like all civets it subsists also on animal food, eating anything which it can kill. It is a creature of mountain forests, living and breeding in holes in trees. Four young were found on one occasion. It is easily tamed and in captivity is described as being of 'cleanly habits, without the unpleasant odour usually emitted by civets'. But when irritated this civet is known to discharge a thin, most fetid yellow fluid from its anal glands. It is probable that the Common Palm Civet shares this habit which is obviously a means of defence. The prominent white vibrissae (whiskers) are highly sensitive and apparently used in some way to ascertain the nature of the food. They are very mobile, and are projected forwards or switched back in the direction of the cheeks. It was observed in the case of a captive pair that fruit, when presented to them, was always first touched with the tips of the projected whiskers before it was accepted. The female when given an apple usually took it in her fore paws and, squatting on her haunches, ate it in the manner of a squirrel eating a nut. This particular pair of civets were caught in a trap baited with ripe tomatoes. They had eaten about fifty of these fruit from a tray left out the night before.

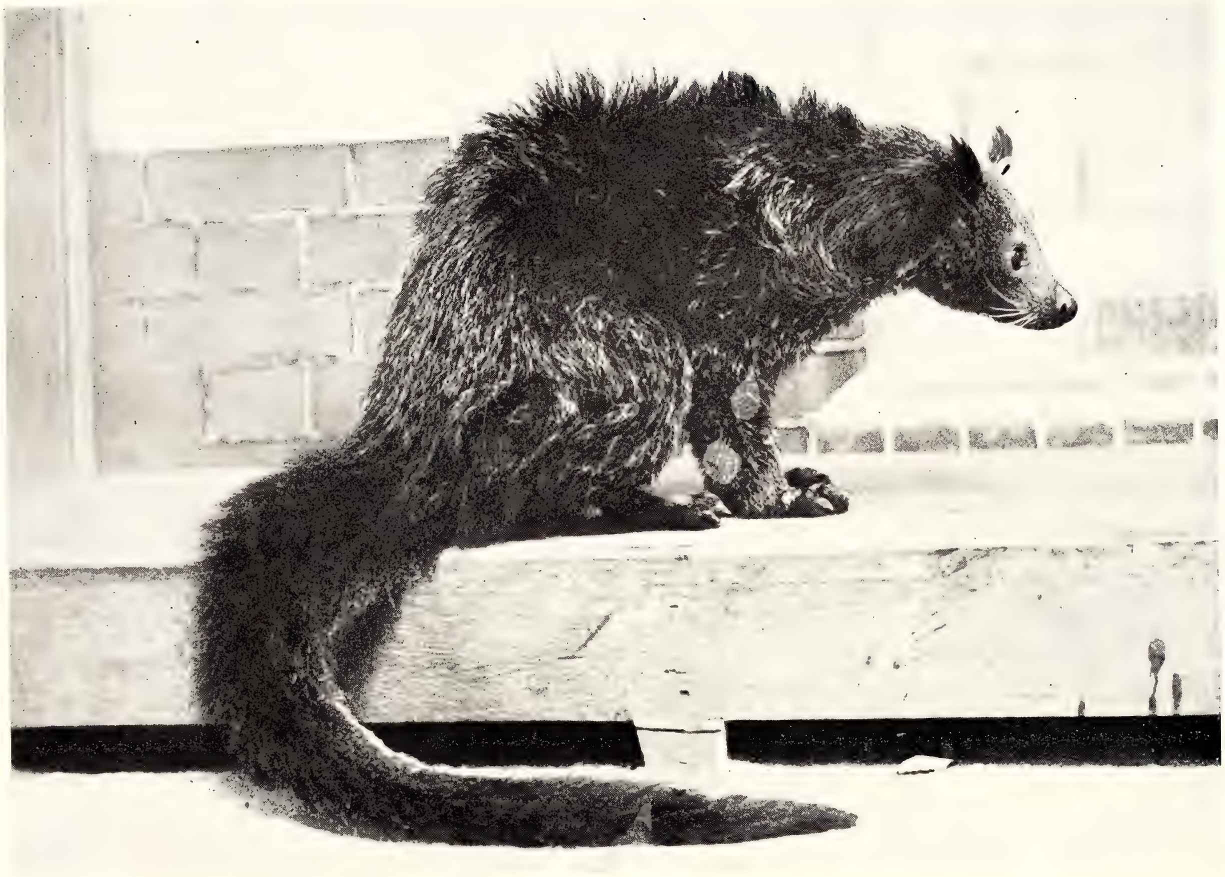


Photo by *F. W. Bond.*

The Binturong or Bear Cat (*Arctitis binturong* Raffles).

THE BINTURONG OR BEAR CAT (*ARCTICTIS BINTURONG* RAFFLES).

The Binturong is easily distinguished from other civets. The back of its ears is clothed with tufts of long hairs, while its long coarse shaggy coat is suggestive of a bear's. Its tail is long and prehensile, very thick at the root, tapering gradually, and covered with bristly straggling hairs longer than those on the body. The soles of its hind feet are naked to the heel. In these characters the Binturong differs from its relatives the Palm Civets. Nevertheless it reveals a resemblance to them in the structure of the scent glands and in the fusion of the pads of the third and fourth toes of its hind feet.

This civet is found in Nepal, Sikhim, Bhutan, Assam, Upper Burma and Indo-China from thence its range extends southward through Arrakan, Tenasserim, Sumatra, Java and Borneo.

The general colouring of the animal is black. The hair of the face, the limbs, the nape, flank and rump may be tipped or 'ringed' with grey, tawny or foxy red. When profuse the variation may reduce the dominant colouring from black to grey or tawny. This is particularly noticeable in animals from India, Burma and Indo-China, which are regarded as a distinct race (*A. b. albifrons*). These northern animals are also characterised by the length and luxuriance of their winter coats. In the typical race, which inhabits Tenasserim and the Malay Peninsula, the winter coat is shorter and the general colour consistently darker, the long hairs never being profusely anulated. The skull, as compared with that of the northern form, is larger and more massive. A large Binturong from Siam had a total length of 66 in. of which 34 in. was the head and body measurement, 32 in. the tail. Recorded weights vary from 13 to 25½ lbs.

The Binturong lives in dense forests. Owing to its seclusive nocturnal habits, it is seldom seen and is therefore comparatively rare in Museum collections. Like other civets, it is carnivorous, feeding on small animals, birds, fishes, earthworms. It also eats fruit. It is arboreal in habit and uses its prehensile tail as an aid in climbing. It is the only placental mammal in the Old World with a truly prehensile tail. Its ability to support itself by its tail has been doubted, but it has been observed that the young at any rate can support themselves by the extremity of the tail alone.

Nothing is known about the breeding habits of this animal.

Sub-family: 3. *PRIONODONTINAE.*

The Tiger Civets or Lisangs.

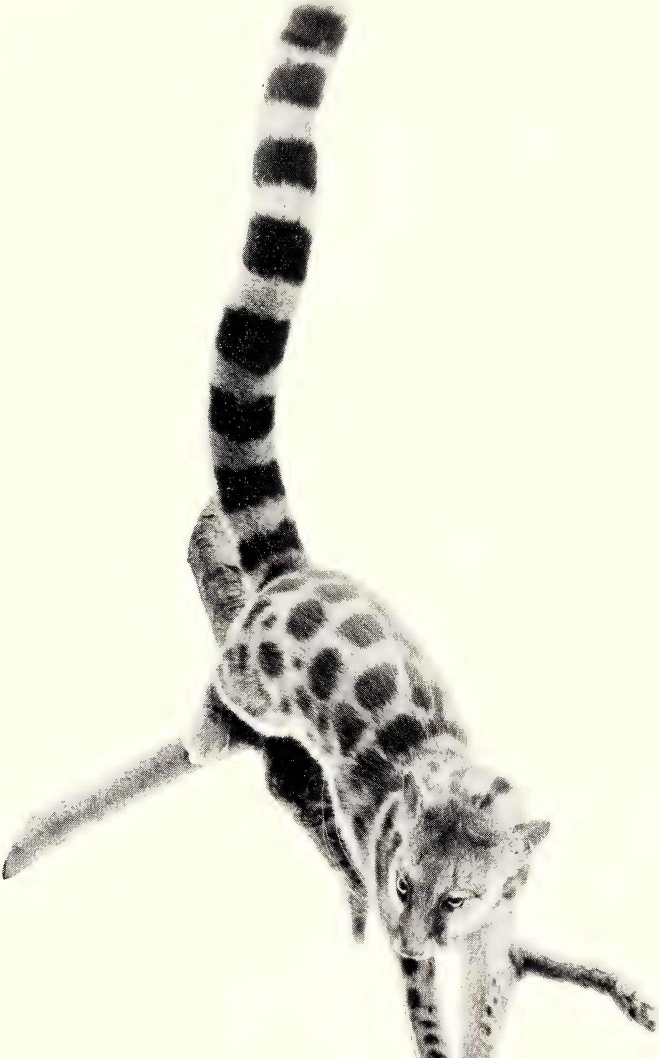
THE SPOTTED TIGER CIVET (*PRIONODON PARDICOLOR* HODGSON).

The beautiful Tiger Civets or Lisangs are now grouped in a sub-division of the tribe—the *Prionodontinae.* They are distinguished from the rest of the Oriental Civets by the absence of scent glands in both sexes, by a characteristic configuration of the genital organs and by the highly specialised character of their teeth. Instead of forty teeth as found in the true civets, they have only thirty-eight. The second upper molar is usually absent or, if present, it is rudimentary. The teeth are sharp and compressed. They indicate that the diet of these animals is carnivorous. They probably feed to some extent on insects also. Their feet differ from those of the Palm Civets (*Paradoxurus* and *Paguma*) in the hairiness of the areas round the pads, and, in this particular, they resemble the true civets (*Viverra*). Their claws are sheathed and therefore completely retractile.

In the absence of scent glands, in the posterior position of the external genitals, in the hairy soled feet and sharp retractile claws, the Tiger Civets show a remarkable combination of feline characters. Even the teeth with their trenchant blades and in their numerical reduction foreshadow the characteristic dentition of cats. Nevertheless the long slender muzzled skull, bodily form and the arrangement of the pads of the feet of the Lisangs essentially class them as civets.

Two species are known. The Spotted Tiger Civet (*Prionodon pardicolor*) and the Banded Tiger Civet (*P. lisang*). Both animals are graceful and delicate in build, sinuous and slender in body, long in the muzzle and very long in the tail. The striking colouration has suggested the name Tiger Civet. The band-like markings of one and the spots of the other differentiate the two species externally.

The Spotted Tiger Civet (*P. pardicolor*) inhabits Nepal, Sikhim, Assam and extends its distribution into Upper Burma and Indo-China. The general colouring ranges from dusky brown to bright buff. The markings consist of two long stripes extending from behind the ears to the shoulders or beyond and of a stripe on each side of the neck. Along the back there are usually two rows of small spinal spots which may coalesce posteriorly to form a stripe. The central row of body markings is flanked on either side with three or four rows of large spots which cover the shoulders, flanks and thighs. The fore legs are spotted to the paws; the hind legs to the thighs, and the tail has about nine complete rings. Animals from Nepal and Sikhim, are distinguished by their darker colouring and generally bolder pattern. The spots are large and symmetrically arranged. They are regarded as representing the typical race which intergrades with



The Spotted Tiger Civet (*Prionodon pardicolor* Hodgson).

the more easterly form, *P. pardicolor persina,* which is generally lighter in hue and has smaller, more oval, less lineally arranged spots.

The Banded Lisang (*P. lisang*) is found in Tenasserim, and the Malay Peninsula, Sumatra, Java, Borneo. It possibly extends its range northwards into Siam. In this species the spots on the body are fused to form six broad longitudinal bands.

The Spotted Tiger Civet hunts in trees or on the ground. It lives and breeds in hollows of decayed trees and preys on small birds and animals. The time of breeding is said to be between February and August and the litter to consist of two young—there being two litters in each year. A tame specimen kept by Hodgson was 'wonderfully docile and tractable, very sensitive to cold and very fond of being petted'. It was fed on raw meat and refused fish or eggs. It was perfectly free from odour.

Sub-family: 4. *ARCTOGALIDINAE.*

The Small-toothed Palm Civets.

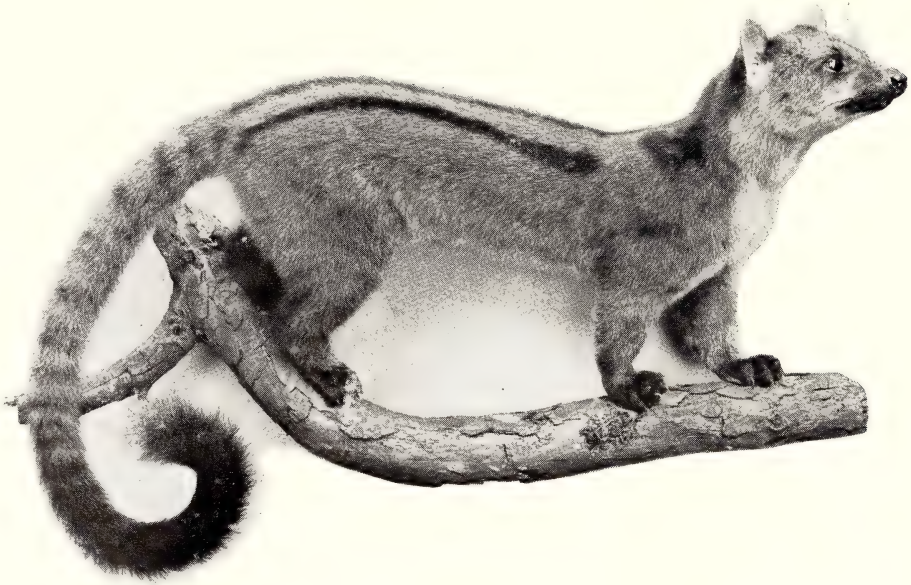
THE WHITE-EARED PALM CIVET (*ARCTOGALIDIA LEUCOTIS* BLYTH).

The Small-toothed Palm Civets (*Arctogalidia*) are now recognised as representing a small distinctive group or sub-family.

Externally they are distinguished from all other civets by the absence of perfume glands in the male, which has no naked glandular area in front of the scrotum. In the female the gland is represented externally by two low ridges of naked skin capable of being folded over in front of the generative orifice and continuous behind on each side with the naked area which surrounds it. The feet of these civets resemble those of the Paradoxures except that the pads of the third and fourth digits of the hind foot are not fused and the carpal or wrist pads of the fore feet are relatively longer. The surface of all the foot pads is smooth and not granular as in *Paradoxurus.* As implied by the name the small-toothed civets are distinguished by their relatively small cheek teeth.

In bodily form and in length of limb and tail, the small-toothed civets resemble the Common Palm Civet. But the markings when present are different. They are limited at most to three dark bands along the back. These may be continuous or broken up into spots. Two species are known, one of which, the White-eared Palm Civet occurs within our area. It ranges from Assam to Laos, southwards through Burma and Western Siam to Tenasserim, the Mergui Archipelago and the Islands of the North-West Coast of the Malay Peninsula. Within this range three forms are recognised. The typical form, *A. leucotis leucotis* is found in Southern Burma, Arrakan, Western Siam, Tenasserim and the Mergui Archipelago. The general colour of its fur ranges from dusky grey to bright tawny. The terminal portion of the back of the ears is covered more or less with white hair, the head is usually darker, the muzzle, paws and the distal portion of the tail brownish, the underside is usually greyish white or creamy buff. A white or creamy patch is usually distinguishable on the chest. There is a white streak on the nose and lower forehead and three blackish or brownish stripes along the back. They are sometimes traceable on the neck. The median stripe is distinct; the lateral more or less broken up into spots, less defined and sometimes absent. Transverse stripes or rings are more or less discernible on the basal and mid region of the tail. In animals inhabiting Assam the more northerly areas of the range the dorsal stripes are wide, black and all equally conspicuous. They are consigned to a second race (*A. l. millsi*). A third smaller form *A. l. macra* is said to occur in Dome Island and possibly in the small islands of the north-west coast of the Malay Peninsula.

The second species *A. trivirgata* ranges from Peninsular Siam to Borneo. In this species the ears not parti-coloured the whole



The White-eared Palm Civet.
Arctogalidia leucotis Blyth.

outer surface of the ear is clothed with black hairs and the skin is similarly pigmented.

The White-eared Palm Civet is thoroughly arboreal in habit, numbers of them were shot on trees round Tenasserim village. The stomach of one contained the remains of squirrels. Though no doubt partly frugivorous, all the Palm Civets in the Tenasserim area live largely on squirrels and they are a considerable factor in keeping down the numbers of these animals, which are so destructive in the coconut plantations.

Sub-family: 5. *HEMIGALINAE.*

The Hemigales.

THE BANDED PALM CIVET (*HEMIGALUS DERBYANUS*).

The Hemigales resemble the true civets (*Viverrinae*) in having scent glands which are present in both sexes. They are less elaborate 'consisting of an elongated pouch with thickened hairy labia situated a little in front of the scrotum in the male, but not extending as far as the base of the penis. In the female the scent glands are situated near the anus and in the vicinity of the vagina. The feet of the Hemigales are intermediate in structure between those of the digitigrade *Viverrinae* and the plantigrade *Paradoxurinae*.

Three genera are included in this group one of which, i.e., the Banded Palm Civet (*Hemigalus derbyanus*) occurs in our area only in Tenasserim from whence its range extends through the Malay Peninsula to Sumatra and Borneo.

The animal is about the size of a Common Palm Civet. It has short close fur of a buffy grey colour. The general colouring of the body is largely determined by the colour of the under-wool and the extent to which it is exposed or covered by the longer hairs. The colour of the under-wool ranges from varying shades of buff to bright orange buff, the longer hairs except on the bands are partly whitish, greyish or buffy. The markings are very distinctive. A longitudinal stripe runs from each ear backwards to meet a broad transverse band across the shoulder. Behind these are four or five broad transverse black stripes on the back, the tail is also banded with black. The dorsal bands are very variable in shape and width and in the extent to which they break up on the flanks.

The species is by no means common. It is said to have absolutely no smell—it is very active and probably largely arboreal. A specimen caught alive was very savage and growled like a wild cat.

FAMILY: III. *MUNGOTIDAE*: MUNGOOSES.

The Mungooses are usually classified as one of the primary sub-divisions of the Civet Tribe. Pocock in a recent study of the group finds a number of positive and negative characters in these animals which he considers sufficient to differentiate them from the Civets and give them the status of a distinct tribe or family. Among the characters which distinguish Mungooses from Civets is the complete absence of perfume glands in both sexes. The absence of these glands in the Mungoose results in a distinctive configuration of the external genital organs. Differences are also seen in the structure of the feet and the ears.

With the exception of one African genus, the ears of mungooses are more or less semicircular in shape and so small that their upper margins do not project above the head or the nape. The structure of the external ear reveals a series of complicated folds which can be shut down one over the other so as to completely close its cavity. This development is not seen in the Civets, animals usually living on the ground or in trees. Mungooses on the other hand frequently live in burrows of their own making, and the complicated mechanism for closing the cavity of the ear is believed to be a special development for excluding dust or dirt when burrowing.

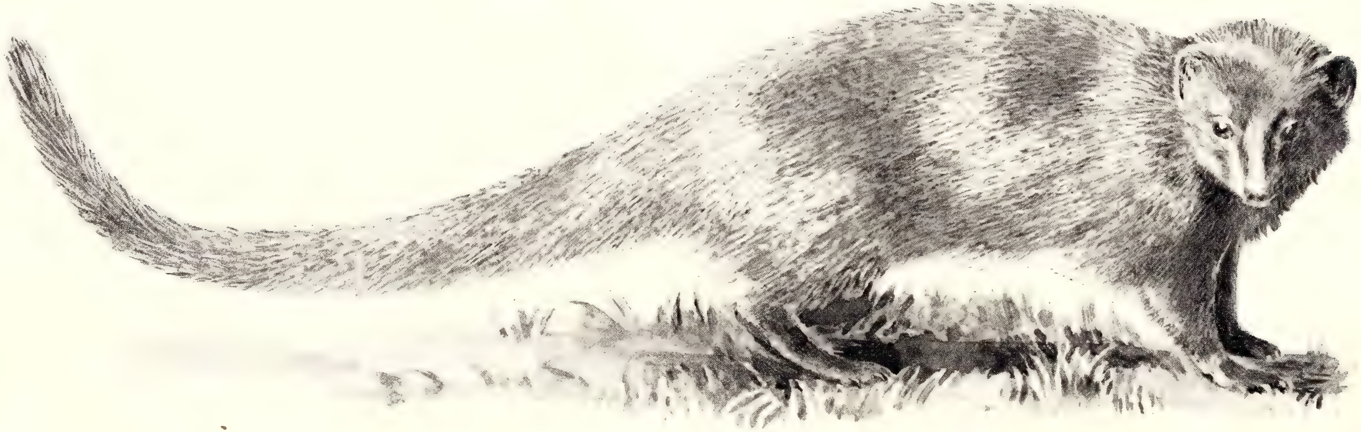
The feet of mungooses are armed with comparatively long or very long claws. They are better developed in the fore feet. The terminal joints of the toes are not provided with ligaments for raising the claws off the ground, nor are the claws furnished with protective sheaths of skin and hence they are always bared. The feet of mungooses however display a wide range of variation. In the standard pattern of foot possessed by many genera, including our Common Mungoose (*Herpestes*), there are 5 toes. The four main digits are well developed but those which correspond to the thumb and the big toe are small, and in some African species these digits disappear altogether, either in the hind foot alone, or both in the hind and fore feet. The four main toes are united with webs—the presence, or the depth of the webs vary in different species. The soles are naked from the central pads to the toes—but the extent to which the area of the heel is covered with hair again varies even in species of the same genus.

Mungooses have no perfume glands—but all of them without exception have anal glands. The secretion of these glands is exuded into a sac or pouch from small openings on each side of or above the anus. The pouch itself surrounds and encloses the anal opening and might be mistaken for an enlarged anus. It is very large and conspicuous in such big species as the Stripe-necked Mungoose. It is less well developed in others and hardly noticeable in the small species of mungooses. The secretion of the anal glands is liquid, foul smelling and often copious. Mungooses have a habit of rubbing the glandular sac against objects in their path; hence it is inferred that one of the purposes of the glands is to leave behind a trail of scent and so familiarize the mungoose with every yard of its surroundings. It so becomes independent of vision and can find its way with precision over any road over which it has once travelled. Again many species of mungooses hunt in packs or family parties and such a trail of scent would help individuals to keep together. Finally one species, i.e. the Crab-eating Mungoose (*Herpestes urva*) is known to project or squirt the aqueous, horribly fetid contents of its anal sac to a great distance. It appears that this species at least makes use of the secretion as a means of defence. How far this habit is common to all Mungooses is not known.

The true Mungooses, those forming the genus *Herpestes*, are well known and familiar animals. They have long weasel-like bodies, and a more or less elongated tail bristling with long hairs. The longer hairs of the body are generally marked with alternate light and dark rings, which give a characteristic speckled or grizzled appearance to the fur. The head has a pointed muzzle with a rather short nose and the middle line of the upper lip is usually grooved. The object of this groove, which is seen in most Mungooses and in other carnivores is to help in the separation of the two halves of the upper lip when raised to clear the teeth. When the groove is obliterated the snout has to be raised to draw the lips away to bare the teeth.

Mungooses have a wide distribution ranging over the greater part of Africa, extending across the Straits of Gibraltar into Spain. Eastwards they are found through Southern Asia as far as the Islands of the Malay region. Of the many genera known, all, but one, are confined to Africa or Madagascar. The only genus found within our limits is *Herpestes* which includes the typical Mungooses. With the exception of the *Susicata* of South Africa —all the genera are incuded in a single sub-family *Herpestinae.*

PLATE LXIII.



The Common Mungoose (*Herpestes edwardsi* Geoff.).

Sub-family: *HERPESTINAE*.

THE COMMON MUNGOOSE (*HERPESTES EDWARDSI* GEOFF.).

The Common Indian Mungoose is found throughout the Peninsula of India from the Himalayas to Cape Comorin. It is said to occur in Assam, but it has not been observed in Burma. The Mungoose found in Ceylon is now considered a distinct species.

This species is so common and so frequently exhibited by itinerant snake-charmers, that it is familiar to all. The pattern of its somewhat long ragged fur is a coarse grizzle produced by the alternate dark and light rings on the hairs. The darker rings on the hairs may be almost black, or grey or some shade of brown, while the lighter rings are more or less white. The grizzling on the face, hands and feet is usually very fine; very coarse on the back and usually less obvious or absent on the under parts.

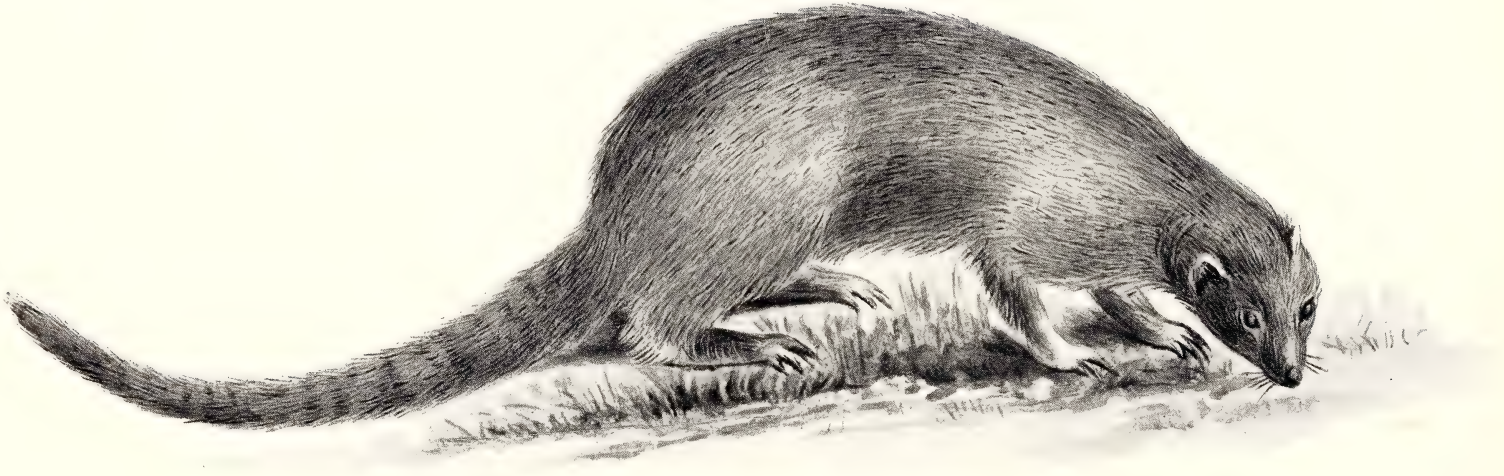
Various geographical races of the Common Mungoose are recognised and differentiated externally by the colouring of the face and feet, of the longer hairs of the body and the shorter under fur. The Common Mungoose (*H. edwardsi ferrugineus*) of Sind, Baluchistan and the more arid parts of the Northern Punjab, is so named because of the ruddy or ferruginous appearance of its head, feet and the tip of its tail. In the typical form (*H. e. edwardsi*) which is found in Nepal, Upper Bengal and Central India—the rusty colouring of these parts is much less pronounced. The annulations of the longer hairs are alternately brown and dirty white, and the under fur is sparse. Then there is a pale silvery coloured form, *H. e. pallens* which is found all over Rajputana. In this race the whole colouring is much lighter—a whitish silvery grey speckled with light brown, and the under fur is very dense and pure white. In the Common Mungoose of the Central Provinces and the Berars, *H. e. moerens*—the ferruginous wash on the face and feet is absent, the grizzling of the hairs is very pronounced, the black rings on the hairs contrasting strongly with the white; the under fur is creamy. In the South Indian race, *H. e. carnaticus*, which is found in Canara, Mysore, Coorg, the general colouring is dark steel grey, finely speckled with deep brown, giving the impression of a relatively dark coloured animal, the under fur is buff.

The Common Mungoose reaches a total length of nearly 3 ft. of which about 18 in. is tail. The average weight is about 3 lbs. Males are considerably larger and heavier than females.

The Mungoose lives in forest areas but is much commoner in cultivated country. It takes shelter under rocks and bushes, or digs a hole for itself in the ground, or uses the maze-like interior of a deserted termite mound, or a hole in the lower part of a tree trunk, or finds suitable shelter in the rafters of a house. Its food is varied. It preys upon rats and mice, snakes, lizards, frogs, insects, scorpions, centipedes, in brief on any creature that it can overcome and kill. It feeds on bird eggs and to a limited extent on vegetable matter. It will eat carrion and is frequently seen feeding on the kills of larger carnivores. It hunts by day and, when accustomed to Man, pays little regard to his presence. But in sipte of excessive inquisitiveness, the mungoose is usually a wary creature, seldom straying far from cover. It can be very destructive, its destructiveness not being limited by its appetite. In a hen house or pigeon coop, a mungoose may achieve wholesale slaughter. Its prowess in killing snakes, rats and other vermin has earned the mungoose a world-wide reputation and has been the reason for its introduction into many countries—not always with the happiest of results. Many and remarkable are the descriptions of encounters between mungooses and snakes. Much has also been written about the supposed immunity of the mungoose to the poison of snakes. The prevalent belief throughout Oriental countries is that a mungoose when bitten seeks as an antidote a herb or root known in India as *Mangus wail* and on eating it, is rid of any harmful effects of snake poisoning. There is no truth in this belief. It is true that the mungoose is less sensitive to the venom and is able to withstand relatively large doses of poison, but its immunity is by no means absolute. A mungoose well and truly bitten and injected with venom sufficient to bring about its death will die like any other animal. All that can be said for it is, that in common with certain warm-blooded animals, like the pig or the hedgehog, it shows a certain resistance to the action of the venom. Cats for instance are less affected by it than dogs and pigs to a lesser extent than cats. Extreme agility in evading a bite gives the mungoose victory over the snake. When the snake strikes, the mungoose generally leaps aside to avoid the thrust and before the snake can recover to strike again, the animal rushes in, seizes and crushes its head with its sharp teeth. Other factors which avert an issue fatal to the mungoose are its tough skin which must be resistant to anything but a direct thrust and its habit of bristling the hairs of its body and tail under stress of excitement. It is suggested that with the hairs standing erect a mungoose looks twice as large as it really is and this must sometimes cause the snake to strike short.

Mungooses breed all the year round. The period of gestation is about sixty days. Three litters may be produced in a single year. A female kept in a semi-domesticated condition in Cannanore, South India, produced a litter of two in May, a second in September, a third in December and a fourth in June of the following year. The mother was in the habit of bringing her babies down from the roof when she came for her food. She climbed as well as a cat and was seen to jump a vertical height of over 4 ft. with a ten-days old baby in her mouth. When the young were able to follow her, she took them out on foraging expeditions. They kept close to her side, stopping when she stopped. The Common Mungoose is frequently seen hunting in couples or in family parties, the mother and the young are sometimes accompanied by a male.

The Mungoose makes a charming and docile pet. It is quite cleanly in its habit and has none of that unpleasant odour one usually finds in wild animals.



The Small Indian Mungoose (*Herpestes auropunctatus* Hodgs.).

THE SMALL INDIAN MUNGOOSE (*HERPESTES AUROPUNCTATUS* HODGS.).

The Small Indian Mungoose is easily distinguished from the Common Mungoose by its small size and shorter and closer fur. It is restricted to the northern portion of India and is found along the lower slopes of the Himalayas from Sikhim to Kashmir and then across the plains from Baluchistan, Sind and the Punjab to Bengal. Southwards its range extends into Rajputana, Gwalior, Gujerat and Kathiawar.

The Small Mungoose is from 18 to 22 in. in total length. Its general colouring ranges from a speckled greyish to golden yellow or to brown. The form found in Baluchistan and Sind, known as *H. a. pallipes*, is distinguished by its pale grey colouring. *H. a. helvus* which is found in Kathiawar, Gujerat and Gwalior is a more yellow in general colour. The forehead is a deep yellow buff—the feet light yellow, the underside paler and the general colour yellow grey minutely speckled with brown. In the typical form found along the Himalayas and in Behar and Bengal, the general colouring is brown, minutely speckled with yellow. In Assam, Manipur and Burma, the Indian species is replaced by another form known as the Small Burmese Mungoose (*H. birmanicus*) which is still darker in colouring and markedly larger in size. Reference must also be made to a third species described under the name of *H. nipalensis*, distinguished from *H. auropunctatus* by the much finer grizzling and generally darker colouration of its coat. It has been taken at a level of 7,000 ft. in Nepal and in Midnapur in Bengal. It is a rare and little known species.

The Small Mungoose lives and breeds in holes apparently burrowed by itself. It is diurnal in habit and is seen about bushes, hedges and cultivated fields. It is a cautious creature generally keeping to cover. Its presence can usually be detected by the worn tracks it leaves along hedges. It feeds on anything that it can kill, on rats and mice, snakes, scorpions, centipedes, wasps and insects of all kinds—as such, like its larger relative it is useful in ridding a house of vermin. Like the Common Mungoose it makes a useful and charming pet but is apparently less certain in temper. A tame female kept in a semi-wild state paired with a wild male on the 4th of July and on the night of the 23rd August after a period of seven weeks produced a litter of three young—one male and two females. Her second litter of two, both females was produced on the 14th April and on the 9th July she produced two more, both females. The newly-born young are described as being remarkably ugly, practically hairless and of a dark mouse colour. The eyes opened on the 16th-17th day after birth. When suckling they purred like a cat. The mother gave vent to a purring sound whenever she was given a drink of milk. She was most restless and for the first two or three weeks would constantly move her offspring from place to place carrying them as a cat carries her kitten. While her young were helpless she was very savage in their defence.

THE RUDDY MUNGOOSE (*HERPESTES SMITHII* GRAY).

The Ruddy Mungoose is a species which is mainly restricted to forest areas. Its range extends from Rajputana, Central and Western India, southward to Ceylon. The species attains a length of approximately 3 ft. of which 1 ft. 6 in. is tail.

The general colouring of the animal is a iron grey, produced by the white, grey and brown rings of its hairs which are tipped with rusty brown. The head and legs are washed with reddish brown and the feet are almost black. This species is easily distinguished from the Common Mungoose by the black tip to its tail. There is however a wide range of variation in colouring which has led to the recognition of six more or less distinct geographical races. The typical form is found in Central and Western India from Hoshangabad southwards to the Nilgiris. The general colour is dark with less rufous, the legs are not conspicuously reddish though the ankles often are. The form found in North-East Rajputana, *H. s. rusanus*, is similar to the typical race in colouring but it is a small animal representing the extreme in the gradual reduction in size from south to north. A third race, *H. s. caneus*, is described from Mount Abu, South-West Rajputana—the general colouring is a clear grizzled grey without the brownish or rufous characteristic of the other races. The form found in the Eastern Ghats, *H. s. jerdoni*, is drabbish grey. The Ceylon form, *H. s. zeylanicus*, is the largest and most richly coloured of all—the whole colouring being richly rufous.

In Mount Abu this species is fairly common. It lives in burrows and shelters among rocks. Family parties have been observed hunting by day. Its food is probably similar to that of other mungooses. Being a creature of forest area it is less commonly observed and nothing is recorded about its breeding habits.

THE NILGIRI BROWN MUNGOOSE (*HERPESTES FUSCUS* WATERHOUSE).

The Nilgiri Brown Mungoose is restricted to the hill forests of the Nilgiris, Palnis, Travancore and Coorg and possibly other hill ranges of South-Western India.

It is a large heavily-built blackish brown mungoose more or less speckled with yellow or brownish white. The paws are almost black. The under fur is brown—the longer hairs of the body have alternate rings of blackish brown and yellow or yellowish white, three or four of each, the darker rings are much wider than the light. The head and body of this mungoose measure about 19 in., the tail 12 in.; the weight of a male is about 6 lbs.

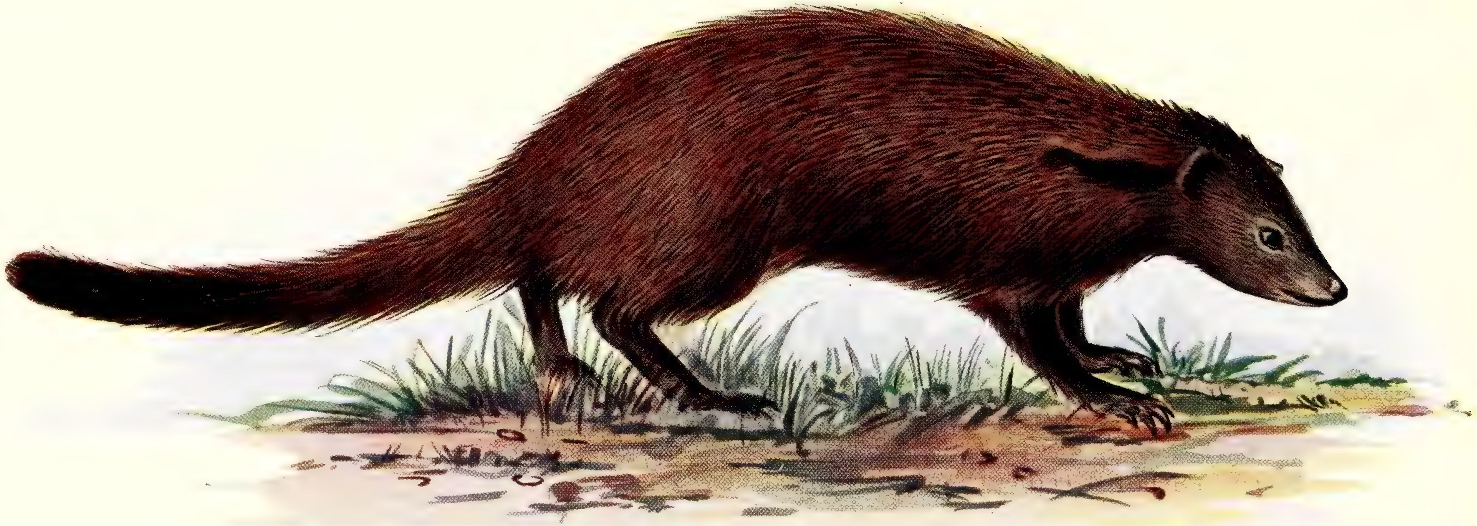
This mungoose is fairly common in the coffee plantations. Nothing has been recorded about its breeding habits.

THE STRIPE-NECKED MUNGOOSE (*HERPESTES VITTICOLLIS* BENNETT).

This Stripe-necked Mungoose, the largest of all Asiatic Mungooses, is found in the hill ranges of South-Western India, from Kanara southward to Ceylon. It is a very handsome creature with an iron grey head, the body speckled with brown, yellow and red. On the lower part of the back and tail there is a profusion of long chestnut hairs. A very distinctive black stripe marks each side of the neck. The end of the tail is black. In life the shape of the head differs from that of the Common Mungoose (*H. edwardsi*), the snout having a slightly upward curve. This mungoose grows to over 3 ft. in length and weighs about 7 lbs.

This species is common all over the Nilgiri and Palni plateaux and is equally abundant in the swamps and rice fields of the Wynaad. Unlike other Indian mungooses it appears to be less plentiful in the neighbourhood of human habitations. Large and powerfully built, these mungooses can be very destructive to game—they hunt a good deal by day and are seen prowling about frequently in couples—presumably following their quarry by scent and then burrowing for it in the ground. These large mungooses have extraordinary tough skins and with their wiry hair are almost proof against dog bites.

Nothing is known about their breeding habits.



The Stripe-necked Mungoose (*Herpestes vitticollis,* Bennett).

THE CRAB-EATING MUNGOOSE (*HERPESTES URVA* HODGSON).

The Crab-eating Mungoose is found at low elevations in the South-Eastern Himalayas, in Assam. Its range extends into Burma, Tenasserim and Southern China.

Like the Stripe-necked Mungoose it is a large and powerfully built creature. The general colouring of its coarse and ragged fur is a dusky iron grey with a greyish surface caused by the long whitish tips to the hairs. A well marked, narrow white stripe runs along each side of the neck from the angle of the mouth to the shoulder. The head is dark brown speckled with white, the legs are similar in colour, but there is no white speckling on the feet. They are usually black. In this species the soles of the hind feet are naked only for about two-thirds of their length, the heel area being covered with hair. The woolly under fur is dark brown at the base then pale brownish yellow. The dimensions of this mungoose are as follows:—Head and body 18-21 in., tail without hair at the end 10-12 in. Unlike other species, the Crab-eating Mungoose is mainly aquatic. It lives on the banks of rivers and streams and preys mainly on frogs, crabs and fishes. A specimen was shot on the Chindwin River while burrowing in a bank. In Kurseong one of these mungooses came repeatedly to a tank stocked with Gold Fish—it took many of the fish and must have dived from the tank side to procure them.

Nothing is known of its breeding habits.

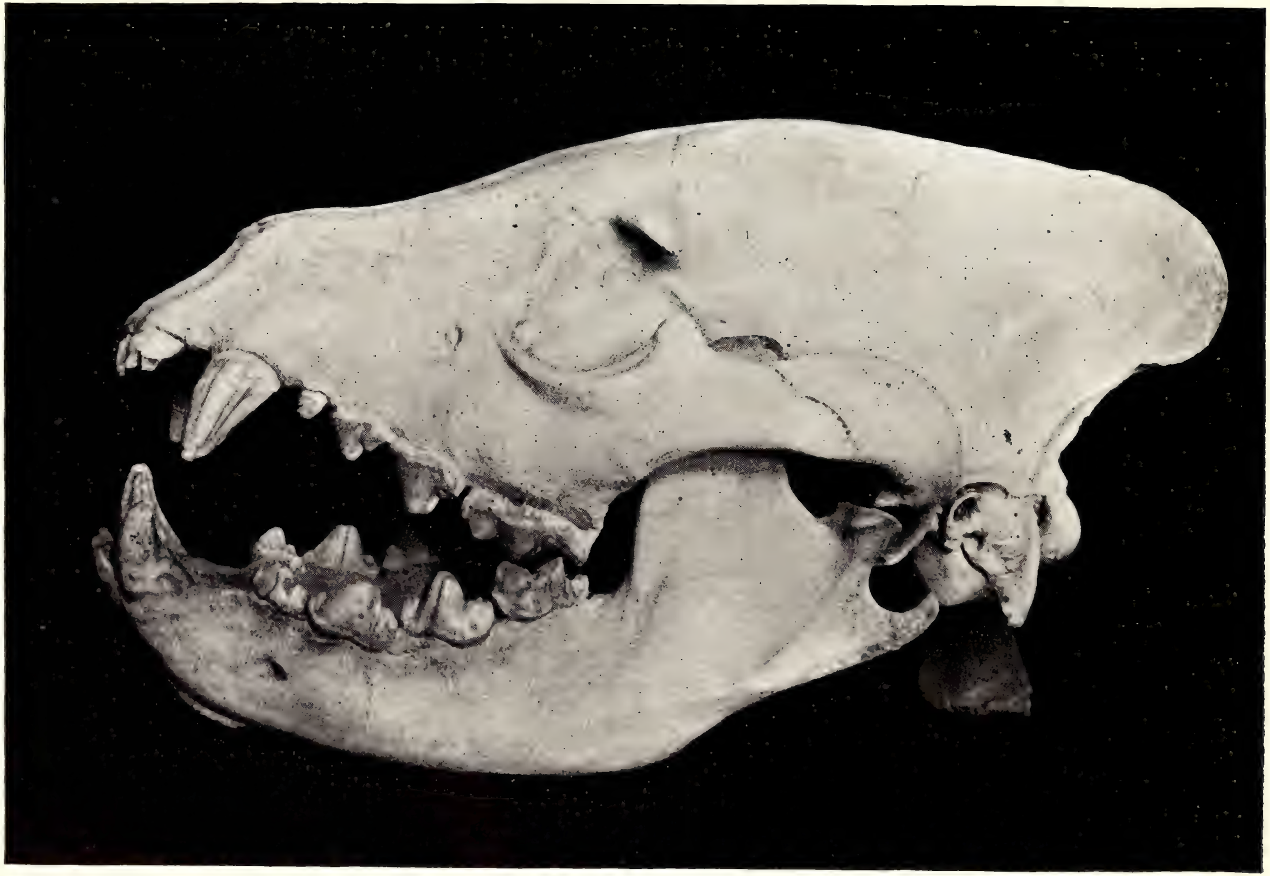
FAMILY: IV. *HYAENIDAE*: HYAENAS.

Hyaenas resemble dogs rather than cats in external build, and may be easily taken for members of the Dog-tribe. Structural details of the skull and the character of the teeth however definitely place the Hyaenas within the Aeluroid or Cat Section of the Carnivores.

The closest relatives of the Hyaenas are believed to be the Civets and Mungooses. Some authors trace a particular affinity between hyaenas and mungooses—both groups of animals having certain points of structure in common. The relationship between hyaenas and civets and their kindred is not very apparent in existing species, but it is more strikingly revealed in the structure of extinct forms which lived during past geological epochs. In the lower part of the Pliocene there occurs an interesting civet-like animal known as the Ictithere which in its structure serves to reveal a close alliance between these two families of Carnivores.

During past epochs, hyaenas inhabited the greater part of Europe and ranged in Asia as far east as China. Fossil species are numerous. No less than 5 different species have been found in the Siwalik fossil beds of the Punjab. One of these extinct forms from Northern India, in the length of its jaws and in the form and number of its teeth makes a close approach to the civets. The teeth of the present day hyaenas are in some respects feline in character and differ in these points from the teeth of civets. A hyaena has 34 teeth in its jaws, a cat 30 and a civet usually 44. The numerical difference in the teeth of cats and hyaenas is accounted for by the retention in the Hyaena of an additional premolar tooth, on each side of both in the upper and lower jaws. A hyaena has 4 premolars and 1 molar on each side in its upper jaw, and 3 premolars and 1 molar in the lower. As in Cats, the molar, the last tooth in a hyaena's upper jaw is reduced to a minute tooth. All the cheek teeth in the lower jaw are conical teeth with sharp cutting blades. But the distinctiveness of the Hyaena's dentition is seen in the great size and strength of the cheek teeth as compared with the canines; more specially in the massive conical crowns of the second and third premolars in both jaws. These teeth carry a strongly pronounced basal ridge which acts as a shield for protecting the gums. This form of tooth is especially designed for gnawing and breaking bones. The teeth and jaws of hyaenas have assumed those characters which adapt them for their peculiar food and habits. The Hyaena is a scavenger. It feeds on the bones and the coarser remains left over by beasts of prey. The whole skull has its shape modified by the enormous development of the muscles which work the jaws and teeth. Few Carnivores have jaws and teeth which can compare in strength or bone crushing power with those of hyaenas.

The Hyaena is a massively built animal with broad short head and a deep body. Its legs are comparatively long—particularly the fore limbs, so that the hind quarters droop. The massive



SKULL OF THE STRIPED HYAENA (*Hyaena hyaena* Linn.).

Few Carnivores have jaws and teeth which can compare in strength and bone crushing power with those of hyaenas.

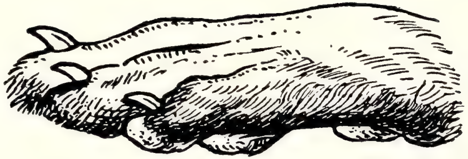


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Fig. 1.—Left forefoot of the Large Civet
(*Viverra zibetha*).

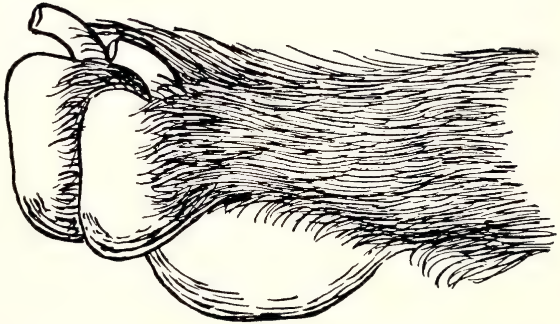

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Fig. 2.—Right hindfoot of Common Hyaena
(*Hyaena hyaena*).

Note the shape and vertical plane of the toe-pads which are uptilted in the Hyaena's foot; the general character of its foot is dog-like and distinct as such from the feet of Cats and Civets.

build of the fore part of the body as compared with the hind, and its knock-kneed hind legs gives the hyaena an awkward, hang-dog appearance. The hair is coarse and shaggy. The thickness of the coat, the colour and the boldness of the markings appear to vary with season.

A hyaena has only 4 toes on its fore and hind feet, the digits corresponding to the thumb and the big toe are absent. The claws are short and blunt, they are unprotected with sheaths and are non-retractile. The feet differ in some respects from the feet of cats or civets. The pads under the toes show several peculiarities. The bases of the toe pads are set at right angles to the central or the plantar pad of the sole. Again the pads are not elliptical but more or less conical in shape. In the uptilting of the toe pads, in their rigidity, compactness, and shape as well as in the short blunt claws the feet of hyaenas resemble those of dogs. The toe pads of cats and civets are usually elliptical in form, and their bases lie in the same plane as the plantar pads of the sole. Hyaenas have anal glands which exude their secretion into a pouch. The presence of an anal pouch in hyaenas and mungooses is cited as part of the evidence of affinity between these two animals. But Pocock has indicated the considerable difference between the anal pouches in the two groups. In mungooses the anus opens in the centre of the anal pouch and the margins of the pouch close right over the anus, also the orifices of the glands are situated tolerably near the anus. In the hyaenas on the other hand, the opening of the pouch appears as a curved slit over the anus, the orifice of the glands are far removed from it.

The existing species of hyaenas are three in number. All of them are included in the genus *Hyaena.* Only one species the Striped Hyaena is found within our limits and extends its range into Africa. The Brown Hyaena (*H. bruneus*) and the Spotted Hyaena (*H. crocuta*) are now limited to Africa. Fossil remains of the Spotted Hyaena have been excavated from some caves near Kurnool in the Madras Presidency, indicating the past existence of this species in India.

THE STRIPED HYAENA (*HYAENA HYAENA* LINN.).

The Striped Hyaena is found throughout the Peninsula of India. It is not found in Ceylon nor in the countries to the east of the Bay of Bengal. In the west its range extends through South-Western Asia into East and North-West Africa. During and before the age of the Mammoth, the Striped Hyaena inhabited a considerable part of Europe. Its bones have been discovered in a cave in the south of France, and teeth of this species have been found in England.

The colour and markings of the hyaena vary considerably with season. Much depends on whether the animal is in fresh coat or has shed its hairs or whether it is in its fuller winter coat. Various races of this animal have been described without any account being taken of these factors. Linnaeus originally gave the name *hyaena* to a hyaena from South Persia. The Persian animal is believed to be similar to the Indian, but if the Indian form is proved to be distinct, it will carry the name *H. h. indica* Blainville.

The Indian Hyaena does not develop a very long winter coat; but it is full, much fuller than the hot weather coat and comparatively soft. The colouring is cream or buffy white and the head tawny buff—the whole colour tone changes to grey or dirty white in the harsher and scantier summer coat. The transverse stripes fade from black to brown—they may be less evident in the fuller winter coat or again tend to become obliterated in cases where the subsequent shedding of the hairs leave the flanks of the animal almost bare.

The Striped Hyaena stands about 3 ft. high at the shoulders—the head and body of a male measures a little over 3½ ft. and the tail with terminal hairs is about 1½ ft. in length. A good-sized female may scale 75 lbs.—the male is about 10 lbs. heavier. Hyaenas are more common in the drier parts of India—particularly among rocky hills or nullahs—or by the outskirts of jungles in the plains. They are found in the open areas of the Nilgiris around and above Ootacamund at elevations ranging from 3,000 to 8,000 ft. They usually shelter in caves, or among boulders, and frequently make a den in an enlarged porcupine's earth. Hyaenas are nocturnal in habit coming out in quest of food about sunset and retiring before sunrise. They usually go about in pairs—parties of five or six have been seen together, but this is unusual with this species. They are great wanderers and their tracks are quite common. The foot print is much like that of a dog—except that the print of the fore foot is much larger than the hind. The pug is easily differentiated from that of a panther by the print of the claws.

The hyaena is mainly a scavenger, and as such performs a useful task. It feeds on the carcases of animals that have died of disease or been killed by other beasts of prey. The carcase is eaten where it lies but portions of it may be carried off into the animal's den. Hyaenas sometimes kill and carry off sheep and

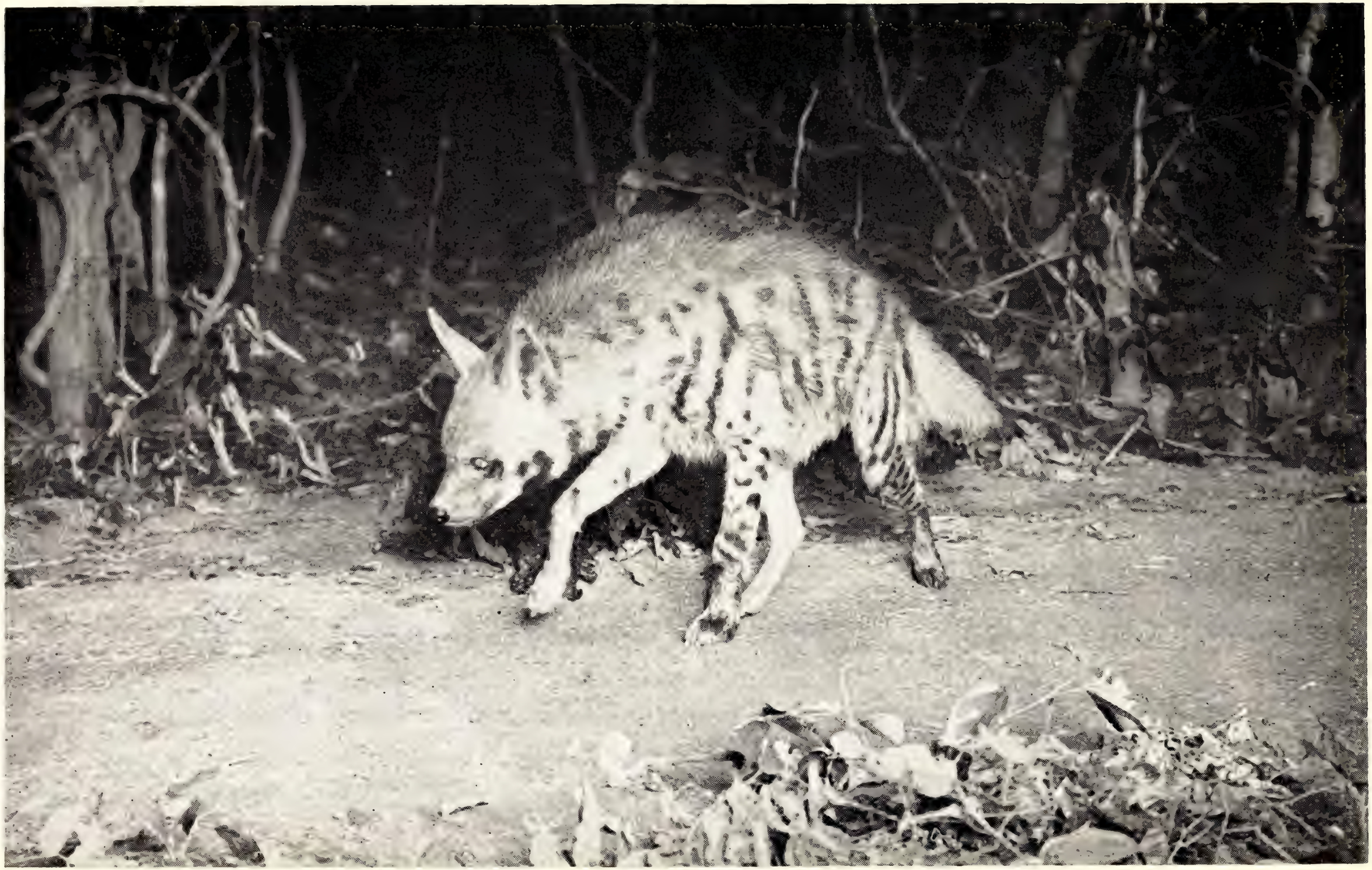

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Photo by F. W. Champion.

The Striped Hyaena (*Hyaena hyaena* Linn).

goats. They are particularly partial to dogs. They do not usually attack larger cattle. There is a record of two cows, tied up as a bait for tiger being killed by a hyaena. The stomachs of the animals were ripped open and they were literally eaten into when yet alive. It is recorded that this species is far more aggressive in Africa than it is in India and that, in Abyssinia, Striped Hyaenas have developed a habit of killing sheep and goats and frequently run amock in a flock killing a dozen or more animals. Fortunately in India our hyaena can in no sense be considered aggressive, despite its bulk and power, it does not attack larger animals, though individuals may be quite prepared, if need be, to appropriate and dispute the kills of panthers or even tigers. There are several instances on record of hyaenas depriving panthers of their kills and of routing them in disputes.

While hunger may give the hyaena inordinate courage, when brought to bay, it does not show fight. Dunbar Brander states it will frequently sham death when harried by a pack of dogs, submitting passively to the direst worrying and ill-treatment.

Though not usually very demonstrative hyaenas give vent to various weird noises, a common sound is a loud laughing chatter.

Little is known about the breeding habits of hyaenas, it is recorded that in the Central Provinces they breed during the cold weather and that the young are generally born in the hot weather —5-6 being produced in a litter.

When taken young, hyaenas are easily tamed and make very affectionate and docile pets.

THE PRESERVATION OF WILD LIFE IN INDIA.
No. 7. THE MADRAS PRESIDENCY.

BY

R. D. RICHMOND, I.F.S. (*retd.*).

Provisions for the Protection of Wild Life.

In a consideration of the preservation of the fauna of the Madras Presidency it is to be remembered that here, as in the rest of British India, the State owns large areas which have been constituted Reserved Forests and which, *if properly administered* in this regard, form permanent abodes for game and other animals. All possible types of country are represented and all the larger animals, with the exception of the antelopes, are thus provided with *potential* sanctuaries. The habitat of the antelope is for the most part the plains and open fields, but there are certain areas of reserved forest in which they are able to, and do, take refuge.

The area under the control of the Forest Department is some 16,000 sq. miles. Under the Forest Act simple trespass is an offence and shooting is not permitted except on license, the grant of which is governed by close conditions. Game protection *is a definite duty* of the forest staff and even if the charges are large (the average of a divisional charge is over 500 sq. miles of forest and that of a beat, the smallest division is 10 sq. miles) the machinery for protection exists.

Thus the fauna is provided with somewhere to live permanently and an organization to protect it, even if the personnel of that organization is small and sometimes neglectful of this particular item of its duties. But while there can be no chance of the 16,000 sq. miles of Reserved Forest being appreciably reduced there is a danger of comparatively small areas essentially the habitat, or within dangerous proximity of the habitat of particular species e.g. the Nilgiri Tahr and the gaur, being alienated and to guard against this a second line of defence has been devised, such areas being declared to be game preserves. The whole 16,000 sq. miles is of course a game preserve, but the whole of it is not *essential* to the preservation of the fauna and, where certain species would find themselves unduly restricted by the alienation of the country they exist in, special steps have been taken to preserve it as public property. Although any area may at any time be closed permanently, or temporarily, to the shooting of all animals, or any particular animal, the policy is not to form preserves of considerable area, in which nothing may be shot, as it is considered that one of the best methods of controlling poaching lies in the presence of licensed sportsmen. Shooting is closely regulated in theory at least; though a license to cover a year's shooting, except in two areas where the shooting is controlled by specially formed associations, may be obtained for the very small sum of 15 shillings. The number of head of each kind which may be shot is prescribed, as is the size of head, the sitting up over water holes or in machans is forbidden and modern tendencies have been guarded against by the prohibition of shooting from motor cars or with artificial light, except in the case of carnivores. Certain animals other than those preserved for sport and which were becoming scarce e.g. the Malabar squirrel and the black monkey are specially protected, while the shooting of game and other birds is regulated to some extent. Orders exist prohibiting the grazing of cattle in areas specially assigned to the gaur, this step being taken to save them from contact with rinderpest. The grant of rewards for the destruction of wild dogs has been resumed.

While the closest attention is paid to certain classes who will not ordinarily infringe the rules, it is to be feared that the Indian license-holder, few of whom shoot for sports' sake, who pays little attention to the conditions of his license, and who will entrust his gun to other parties, is poorly controlled. And of recent years the policy has been to grant licenses to possess arms to a greater and greater extent, and any one with a gun who lives within reach of areas containing game, is a potential poacher. Also a class of license, that for crop protection, is responsible for considerable damage; damage which might be mitigated would those responsible consent to the peasant being put to the inconvenience of depositing his arm with the police at times when there are no crops to protect. A further handicap to game conservation is the extremely rapid Indianization of the Forest Service: officers of the new class take at present little or no interest in natural history, or in the preservation of wild life and, as a rule, other activities prevent them from paying sufficient attention to a part of their duties with which they are in little personal sympathy. The difficulty is that there is no public opinion on the subject of game preservation in the country and until this has been created, little will be accomplished. The jungleman is principally poacher, for food or to obtain meat for sale.

The Status of Wild Life.

In the Godavari, where the gaur is probably on the increase, chital and sambur are not as numerous as they were: much of the damage, strangely enough, being done with the bow and arrow. For very many years there has been little game in the Ganjam district, so little in fact that the balance of nature is upset and the district is principally notorious for man-eating tigers. The populated north of the vast tract of Vizagapatam and Jeypore, which is a native state, has little game left in it, but the sparsely populated south is well off for all kinds and is the only place in the Madras Presidency where the buffalo is found. Very little of these areas are Reserved forests. The Eastern Ghats are of little interest, except for chinkara at the foothills and some antelope on the plains. The 2,000 sq. miles of the

Nallamalai hills contain plenty of game of all kinds and it is strange that the gaur does not occur. What are known as the Ceded Districts contain very little at the present day. Once the haunt of the elephant, forest destruction preceding cultivation, and accelerated by the goat, has had the inevitable result of driving the game away as well as of reducing parts of the country almost to the condition of desert. There are however, still antelope and chinkara, while sambur are to be found on the hills of Cuddapah and Chittoor; in fact there is still plenty of game in the latter district, even if the glory of the Chamla Valley has departed—due to fewer Europeans visiting it. The Javadi and Salem hills contain gaur which are closely protected and which do some damage to forest works, but the rest of the game animals are poorly represented. The same may be said of the Madura District, principally interesting from the fact that a herd of gaur was cut off when the railway was constructed and, well protected, have persisted. The Palni hills of Madura provide representative animals on the slopes, the Nilgiri goat (*Hemitragus hylocrius*) on the edges of the plateau (7,000 ft.), while the gaur occasionally visits the plateau. But protection is none too good in spite of a constituted game association. Tinnevelly is moderately well off and here too the Nilgiri goat is to be found, though the numbers have decreased considerably. The forest area of South Coimbatore is famous for the 'Grassy Hills', on the borders of the Cochin State, at an elevation of 6,000-8,000 ft.; the Nilgiri goat being common, while elephant and gaur are to be found on the open grass. This forest division contains, in one particular part, the white bison which appears to be developing into a distinct variety.

The North Coimbatore and Kollegal divisions have perhaps suffered more than most, including, as they do, so many villages, from the increase of poaching; but other and perhaps temporary factors are at work, if anything is to be inferred from the varying incidence of the number of game animals in a certain locality. Reported in 1893 as denuded of game, once very common, the old state of affairs was restored from 1901 onwards while there is now again complaint of scarcity. Elephants have increased to an inconvenient extent in numbers of recent years.

The forests of Malabar, that is to say the protected areas, for there are very considerable tracts of private forest land in which there is no protection or shooting regulation, are for the most part exceedingly well stocked with game and other animals of all kinds, particularly elephant and gaur—the forest areas belonging to Government are more compact than elsewhere and there is far less population inside them and on their edges—consequently there is less poaching.

To judge by the complaints of damage done by wild animals it would be supposed that South Kanara teemed with wild life; but such is far from being the case, the complaints being in reinforcement of agitation for the abolition of the forests. But in the upper hills there are sambur and there are a few gaur—also elephants. The tiger, accused of killing great numbers of domesticated cattle (and it is a fact that the mortality of cattle from wild animals is greater here than elsewhere) is in fact rare, the delinquent being the panther, living in low rocky hills distant from the real forests, and killing cattle as there is nothing else to live on.

The Nilgiris, a district at elevations from 1,000-8,000 ft., is richer in fauna of all kinds than any other. Naturally well endowed in this respect, protection in the last forty or fifty years has been good on the whole. The shooting is regulated by a Game Association, the members of which are those who take out annual shooting licenses—these are mostly Europeans—and a special protective staff is entertained. The Nilgiri Tahr, its habitat is the Nilgiris (north of which the family is unrepresented until the tahr is found in the Himalayas), Madura, parts of Malabar, Cochin, Travancore and Tinnevelly in the extreme south, has definitely increased of recent years.; sambur abound on the plateau (a beneficial practice is now permitted in the shooting of a limited number of hinds), gaur, vulnerable to epidemics of rinderpest from time to time, chital and sambur are common on the slopes and lower plateau, muntjac are exceedingly common, as are also elephants. Tigers are commonly found on the upper plateau. The extension of the planting industry has reduced the area available, but there is still plenty of room and, whereas certain animals may appear to be reduced in numbers from time to time in different places, there seems to be no ground for apprehension that game animals are decreasing. A falling off in the number of sambur stags shot by license-holders by no means justifies the belief that this deer is becoming more scarce—the fact is that there are fewer warrantable stags to shoot for the reason that the best have been shot year after year.

Recommendations.

There is no need to apprehend that the fauna of Madras is decreasing to a dangerous extent *at present*, though it would be idle to pretend that there are not forces at work which should be guarded against. Apathy on the part of a new class of officer, who is not interested in sport or natural history, and the increased facility with which arms may be legally possessed may both be corrected. Public opinion may in course of time be developed, though this will necessarily be a slow process and it will be fatal if the impression is formed that the interests of the cultivator will not be protected. There is ample room for the wild animals in the considerable areas of forest land which is the property of the state and which need never be alienated, all that is required is the determination to make protection effective. 'Preserves', in this Presidency at all events, appear to be uncalled for—the whole of the forest area is a 'preserve'—and the regulations permit of certain parts being closed to shooting either permanently or temporarily. 'National Parks', if by these are meant areas which are specially protected and in which no shooting by the public is allowed, but which are maintained so that the public may see and study the habits of wild animals, are on a different footing. These should be of great general interest and educational value and tend to promote that public opinion which is so desirable. A difficulty in connection with these 'National Parks', however, is their location; they should be near areas of considerable population, and be served by roads; also the forest should be of a type which allows of the animals being easily seen. It is perhaps sometimes overlooked that conditions in different countries vary and that what may be suitable in Africa, for example, is inappropriate in Madras.

It will not be easy to find an area which fulfils all the essentials; a considerable sum of money will ultimately be required and it cannot be expected that National Parks will be self-supporting; but the first steps are being taken and it may be hoped that they will bear fruit.

Suggestions are from time to time heard as to the desirability of establishing a separate game department under a Warden. Those who advance this view possibly have the conditions of Africa in mind; in India there is already an organisation one of the duties of which is to protect the animals as in the case of the other contents of the forest—the appointment of a Warden, and some additional staff, would lead to dual control and friction: nor is there any need for it. Properly controlled and supported, with some strengthening in certain places, the ordinary staff of the Forest Department *should* be well able to do what is required.

But the Department requires greater support. It is essential that the authority responsible for the issue of licenses under the Arms Act should consult the forest authorities on applications, in respect of residents in, or near, the forest; that guns concerned in shooting offences be confiscated, that the Magistracy should attach greater importance to offences of this class and it is extremely desirable that the sale of flesh at certain seasons should be declared illegal. Finally it is anomalous that the head of the Forest Department should, in theory, be unconcerned with this branch of the work of his department, at present in the hands of an authority which has no occasion to go into the forests and which is not in any way concerned with other branches of forest administration.

COMMENTS ON Mr. RICHMOND'S NOTE.

BY

R. C. Morris.

In the note on the 'Game Preservation in the Madras Presidency' it is mentioned that there is an area of 16,000 sq. miles providing a natural Sanctuary for the fauna with the Forest Department as an organisation to protect it, the protection of game being a definite duty of the Forest staff.

This may be said to apply to nearly every country holding forests with a Forest Department to control the same. Although in theory the machinery for protection exists, and shooting is regulated, in practice it has been found, and I fear always will be found, that Game Protection is relegated to the background as Forest Officers find that the whole of their time is taken up by other work, in other words the preservation of the fauna takes a back seat to the protection of the flora. That the Forest Department have failed to afford the necessary protection for the fauna cannot be gainsaid, nor can Forest Officers be expected to devote the required amount of time to Game Preservation, however interested they might be in the matter, and I am sorry to say that in many cases these days there is little interest.

It is mentioned that areas denuded of game in 1893 were restored to the old state of affairs from 1901 onwards. I think it would be more correct to have said 'denuded of chital' instead of game. I am fairly sure that the author had before him a note written by a Collector in 1893, and if I remember rightly this only referred to chital in a particular area.

I do not agree with the opinion that there is no cause for apprehension that the fauna of the Madras Presidency is decreasing to a dangerous extent. This statement covers the whole of the fauna and I consider that chital, black buck and chinkara have certainly decreased to a dangerous extent and will be extinct in South India not many years hence unless steps are taken in the matter. The Nilgai in South India have already gone the same way.

I entirely disagree with the opinion that the appointment of a Game Warden and special staff for the control of a National Park, Game Sanctuary for the fauna in the Ordinary Reserves is unnecessary, nor can I see how the present staff of the Forest Department will be in any better position to control the fauna, still less a National Park or Game Sanctuary, than it has been in the past. I cannot see how any friction could arise if the Chief Conservator of Forests controlled both the Forest and Game Departments, the Game Warden if required being a Forest Officer specially seconded for this purpose as was the case in Burma. To my mind it is quite certain that a Game Department would improve matters considerably whether a National Park was established or not, and if any doubt exists on this point a visit to Ceylon might be made to compare the condition of game in areas under the control of the Game Association or Game Department in Ceylon with that in the areas controlled only by the Forest Department.

I do agree with the author in his opinion that the present dual control in connection with shooting licenses should cease. Shooting licenses should be issued by the District Forest Officers (on behalf of the Collectors). Further no arms licenses should be issued by District Magistrates to people living near Reserved or Unreserved forests without the District Forest Officers being consulted in the matter: more important still Magistrates should be made to take a far more serious view of poaching offences and offences under the Arms Act (illegal possession of guns) than they do at present. Punishments meted out to poachers are ridiculous: an inveterate poacher is not worried at all at the prospect of serving two or three months' imprisonment occasionally.

The status of Wild Life in the Madras Presidency may be put shortly as follows:—

1. (*a*) *Within Government Forests.*

In one or two districts, take Ganjam for example, there is little or no game left. In other districts a few species exist thinly scattered, and *in parts* of the districts of Coimbatore, Malabar, Madura and South Kanara game, with the exception of chital and antelope, is still fairly plentiful. The reason is not far to seek. These districts hold areas which *have been* difficult of access to the poacher and here game still holds its own. Chital and antelope live in country that is easily poached and unless early measures are taken chital, black buck and chinkara will be exterminated in South India not very many years hence, just as the Nilgai have been. I say that certain areas 'have been' inaccessible to poachers as with modern guns and cheap electric torches the present day poacher is a far more dangerous enemy to game than he was in the past. Poachers are now penetrating into parts they have never been into before, and it is a certainty that in course of time no part of the jungle will be free from the poachers' activities. Take for example the Billigirirangans. Were it not for the presence of Planters residing on the hills to put a curb on poaching sambhur on the hills would be exterminated. At the northern end of the hills, in the Kollegal Division far from these Estates, very few sambhur are left, most of them have been shot out by the Sholagas who hold guns (some time back 14 guns were seized in one day ,but the Sholagas hold just as many now). In the Mysore part of the hills very few sambhur eixst although the area is known as the Chamarajnagar Game Sanctuary. What applies here also applies to other districts with the exception of the Nilgiris where the Nilgiri Game Association run a fairly good show. In the more accessible tracts of the Coimbatore, Malabar, Madura and South Kanara districts the status of Wild Life is parlous in the extreme.

The new experimental measure for the compulsory inoculation of village cattle in the Kollegal and North Coimbatore Divisions should keep bison comparatively free from rinderpest, and it is a measure that I should like to see carried out in other districts where biosn occur.

(*b*) *Outside Government Forests.*

Very little game exists, and the remnant is rapidly vanishing.

2. (*a*) *The species of animals for the protection of which there is a special urgency.*

Chital, black buck, chinkara, 4-horned antelope and, in some parts, sambhur.

(*b*) *Animals which do not require vigorous protection but need a modified form of protection.*

Bison only should be placed in this category.

LEGISLATION.

3. *The effectiveness of the laws at present in force in various Provinces which regulate the killing or trapping of Wild Life in Government Forests. Proposals for their improvement where necessary, particularly in regard to the use of motor cars, dazzle light, nets and pits.*

The present laws in force in the Madras Presidency would be very effective if properly enforced. Suggested improvements are:

(1) Considerable moderation in the issue of gun licenses, especially in areas adjacent to reserved or unreserved forests; (2) the necessity of Magistrates consulting District Forest Officers on all applications for arms licenses when the applicants reside within poachable distance of reserved or unreserved forests; (3) the necessity for far more severe and deterrent punishments on offenders convicted under the Forest Laws and the Arms Act; (4) the necessity for District Forest Officers to treat the subject of Game Preservation as one of their most important duties; (5) stricter rules in regard to the use of motor cars for shooting. It is suggested that the Governments concerned should prohibit the shooting of large or small game within 100 to 200 yards of any public road.

There is already a rule against shooting any animals except the carnivores with a torchlight, and I do not think this can be improved upon if enforced properly.

The stricter enforcement of the laws against netting and pitting, both of which are carried on in out-of-the-way parts (instances have been reported recently), and the prohibition of either netting or pitting in *unreserved* forests.

4. *The control of slaughter of Wild Life outside Government Forests.*

This is a more difficult matter, and I am not sure whether Government have any legal right to put forward measures for the control of slaughter in private lands. This is probably a case of educating the landowners on the matter.

5. *Legislation controlling sale of hides, horns, etc.*

In the Madras Presidency I do not think there is any legislation in force at present prohibiting the marketing of flesh, hides and horns of game animals either in close season or out and such legislation should be enacted at a very early date. A law against the export of plumage exists; and legislation prohibiting the marketing of all parts of game animals throughout the year is very necessary.

Under the heading of legislation I should like to see the Indian chevrotain or Mouse Deer added to the list of animals completely protected, and the use of a shot gun (buck shot) on all deer and antelope should be prohibited.

In Coimbatore a slip is now added to all shooting licenses asking the licensees to look for and report to the District Forest Officer of the Division in which they are shooting all cases of poachers' machans on trees, or hides on the ground, over water and salt-licks which they may come across and this should be made one of the clauses in the Rules attached to shooting licenses. If Government could be persuaded to agree to the immediate dismissal of any Forest Guard in whose beat an illicit hide or machan is found the would-be poacher would receive a tremendous knock, as no Forest Guard is going to risk losing his job to help a poacher whatever inducement the latter may offer him.

ADMINISTRATION.

6. (*a*) *The desirability of definitely laying on the Forest Department the duty of preserving the Fauna and Flora (and not merely trees) in the areas in their charge;* (*b*) *the desirability of creating a distinct organisation within the Forest Department for the protection of wild animals within Government Forests.*

I consider it is definitely desirable to create a special department, to be controlled by the Chief Conservator of Forests, for the protection of wild animals within Government Reserved and Unreserved Forests. The control of both the Forest and Game Departments by the Chief Conservator of the Province should remove most causes of friction that may otherwise occur between the two Departments, whether the Game Warden is a seconded Forest Officer or not. However much District Forest Officers are encouraged to treat Game Preservation in the proper light this interest is bound to fade again in course of time and will only be kept alive by the existence of a Game Department with which the Forest Officers will have to co-operate in full. The existence of a Game Department is bound to improve matters whether National Parks or Game Sanctuaries are established or not.

7. *The formation of National Parks or in the alternative of strict Nature Reserves where possible, and* 8. *The question of making separate financial provision or the creation of a special fund for carrying out the work of conservation.*

If the formation of a National Park in the Madras Presidency is considered unfeasible, I do not think the necessity for a separate financial provision will arise as a Game Department would presumably be financed under an increased Forest Budget; but for the creation of a National Park or Game Sanctuaries separate financial provision would be required. Two areas do exist in the Madras Presidency which could be turned into National Parks provided communications are improved, and here the value of having the Chief Conservator of Forests as the head of both Departments will be seen, as in one of the areas the improvement of communications will assist considerably in the extraction of forest produce. In this case the term 'National Park' will not be correct as forest work will be carried on in that area, and it would be a Game Sanctuary, but in either category the control of the fauna in this area should fall on a Game Department, and would have to have a special staff in permanent control special funds for financing the work being drawn from the most obvious sources, i.e., the revenue derived from:—

(1) Game licenses;
(2) Licenses and permits for sporting arms;
(3) Import and export licenses for the above arms;
(4) Duty on sporting arms and cartridges;
(5) Licenses to sell or store sporting arms and cartridges;
(6) Fishing licenses;
(7) Fines and penalties for infringement of shooting rules;
(8) Fines imposed for offences connected with poaching etc;
(9) Sales of confiscated and picked up trophies and parts of game animals and birds (both game and protected).

The other area is I consider eminently suitable for the formation of a National Park and should be self-supporting in course of time.

General.

9. *The position of the Cultivator in relation to Wild Life and the provision which might be made for the protection of human life and property in the neighbourhood of forests from the ravages of wild beasts.*

The damage done by wild beasts, *other than elephants*, is very much exaggerated. Elephants do a lot of damage, in fact unless early measures are taken to deal with the elephant menace it will be, and has been in the last few years, an intolerable hardship on the cultivator whose lands are adjacent to or surrounded by forests in which elephants occur. It is suggested that one of the best methods to meet the elephant problem is the appointment of three or four salaried men to shoot the leading offending bulls at the time crops are being raided. I say 'bulls' as bulls are generally the chief offenders, they play havoc with the crops, either solitaries, in pairs, or as leaders of herds. The experience in Africa has been, on a few of their leaders being shot, elephants soon recognise raiding crops to be an unhealthy pastime. It is only during the harvest season, or for a month before, that the damage from elephant occurs. Ivory from elephants shot would be handed over to Government and should cover the salaries paid out. A strong fence round fields will keep out most of the other animals that matter. The protection of human life hardly comes into the question as regards the cultivated areas of the Madras Presidency, except it be from elephants, and here again the shooting of solitary tuskers has long been advocated being as often as not potential rogues, and nowadays many of them are wounded by the muzzle-loading and cheap breech-loading guns of the Ryots in cultivation. Solitaries which are not necessary for the propagation of the species, generally hard to tame if captured, often frequenting public roads and bridle paths, are a terror to travellers, and sooner or later an accident occurs. I have said 'tuskers' as mucknas are not generally vicious, being usually of a docile temperament.

One of the most important aspects of bird protection should be kept well to the fore: the necessity of showing the cultivator where he does wrong in killing out many of the species of birds found on his land, and for this purpose an ecological bird survey should be made of every province which will prove of immense value in demonstrating the birds that are the friends and the enemies of the cultivator.

10. *Measures to restrict the possession or use of weapons which may be used for poaching.*

A great curb to poaching would be the recall of all guns issued for the purpose of crop protection; immediately harvesting is over, the issue of weapons to applicants must be cutrailed: this is very important.

Rewards should be offered, *and paid out promptly*, for information leading to the seizure of illicit guns, *and action taken to recover the weapons immediately information is received.* What frequently happens is this: A Sub-Inspector of Police receives information that an illicit gun is to be found (either in a hut, a grain pit, a hay-stack or more frequently in a watchman's shelter on a tree). Instead of prompt action being taken days elapse before *constables* are sent to recover the weapon and in the meantime it has been removed. To my knowledge this has occurred time and again, the informers get no reward or compensation for their trouble, and so give no further information in regard to any other weapons they may get to know of. The same delay has been experienced over Range Officers taking action when illicit machans and hides are reported, even when instructed to proceed immediately to the spot by their District Forest Officers. A few days are allowed to elapse before action is taken, in the meantime the poachers get wind of the matter and the machans or hides are removed.

A Forest Guard should be immediately dismissed if a poaching case in his beat is not reported by him. It is suggested that a Monegar, Village Munsiff, or Village Headman should be heavily fined if a case of illicit possession of arms is discovered in his village or villages under his jurisdiction. There is not the slightest doubt that every Village Munsiff or Headman knows exactly what arms there are in the village or villages under his jurisdiction, whether licensed or unlicensed.

No. 8. HYDERĀBĀD STATE.

BY

SALIM ALI.

The Hyderābād State occupies an area of about 82,000 sq. miles of the Deccan Plateau. Its north-eastern boundary adjoins the Chanda District of the Central Provinces, renowned among sportsmen of the last century as an ideal game country. Hyderābād State at one time, not so very long ago, provided some of the finest big game shooting—especially tiger—in India, and even at the present day inspite of the penetration and colonization of vast tracts of forest land and the consequent depletion of wild life, there still exist in the Dominions parts which are in no wise inferior to the best that can be found elsewhere within the Indian Empire. Some idea of the abundance of tigers in the last century can be obtained from the fact that the famous shikari Col. Nightingale (who died at Bolarum in 1868) alone killed during his service over 300 tigers, the majority of which were in Hyderābād territory.[1]

Status of Wild Life.

The wild life of Hyderābād is as varied as it is interesting. Tigers are still comparatively numerous in the forests of the Eastern and Western Circles, which also contain some gaur. Leopards and sloth bears are fairly plentiful; sambhur, cheetal, muntjac, four-horned antelope, nilgai, black buck, chinkara, hyaenas, wild dogs, jackals and wild pig are found in suitable localities, while there still remain a few cheetahs or hunting-leopards and wolves. Besides these, porcupines and many other species of smaller mammals are found. A few buffalo are said to occur in the Eturnagaram Range of the Mūlūg Talūka (Warangal District) but their numbers are very small. The shooting of buffalo and gaur has been totally prohibited for some years past, owing to which they have, for the time being, been saved from extinction.

In his *Reminiscences of Sport in India* (published 1885) Major-General E. F. Burton mentions a herd of twelve wild elephants near 'Percall' Lake in 1847, which were said to be descendants of animals that had broken loose in the wars about 200 years previously. In 1866 this herd had increased to fourteen or fifteen individuals. Nothing is known as to what became of them until the 1909 edition of the *Imperial Gazetteer*, which stated that there was one single female still left in those parts. Despite the above, however, Nawab Hāmid Yār Jung Bahādūr, the Inspector-General of Forests, informs me that no elephants in a wild state have been heard of in Parkal Taluka within the memory of the oldest man living.

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[1] It is of interest to note that since this article was written, the heir-apparent Prince Āzam Jah Bahādūr, and partly recently (*ca.* May 1935) in the course of 33 days shooting killed 35 tigers, in addition to bears, sambhur and other game in the preserves of Pākhāl, Mūlūg and elsewhere.

Provision for Protection of Wild Life.

Up to the year 1897 or thereabouts, there were apparently no restrictions in Hyderābād against tiger or any other shooting. The present Game Regulations came into force from 28 September 1914. For the purpose of their application, the Dominions are divided into four circles which include both reserved and open forests. They also include Jāgīr and Samastān forests as well as the private Game Preserves or *Shikārgāhs* of His Exalted Highness the Nizām. The Pāigāh Nobles, who have extensive estates (the largest being that of Nawab Moin-ud-dowla Bahādūr which covers an area of 1,287 sq. miles) the owners of Samastāns, and the Jāgīrdārs manage their own forests and are entitled to regulate shooting on their private domains. The rules relating to close seasons, shooting of does and immature animals, and the restriction against shooting buffalo, guar and hunting-leopards are, however, applicable to them. Theoretically speaking, therefore, no shooting can be done in the State without either a license from the Government or a permit from the Pāigāh Nobles, Samastān-owners or Jāgīrdārs concerned.

According to the Game Regulations only one circle is thrown open for shooting each year from 1 March to 31 May and again for ten days at Christmas. For black buck the open season is 1 December to 31 May. Only half the number of districts comprising such circles are open at a time, and shooting areas in these open districts are also defined. Certain areas are thrown open and others closed to tiger shooting from time to time depending upon the increase or decrease of these animals.

Forest Areas.

The most important game forests at present are:

Eastern Circle.

1. Warangal.
2. Khammam.
3. Karimnagar.
4. Nizāmābād.

Western Circle.

1. Asifābād (formerly known as Jangāon).
2. Nīrmal.
3. Mahbūbnagar.

In addition to the above, the forests of Garlāh Jāgīr and Pāloncha Samastān contain big game.

The three principal *Shikārgāhs* of H. E. H. the Nizām are:

1. Pākhāl, situated in the Pākhāl and Mahbūbābād Talūkas of Warangal District and managed by the Forest Department under whom there is a special *Mūntazim* or Warden and a staff of watchers. Area 345.75 sq. miles,

2. Saroonagar, and
3. Alampalli both situated in the Atrāf-e-Balda District and managed by a special establishment under the Sadrūl Mohām, Sarf-e-khās Mūbārak.

The Pākhāl Preserve contains mostly all the big game animals of the State, while the other two which are in open scrub country, have chiefly black buck, hare, partridge and quail.

The *Shikārgāhs* are governed by special rules sanctioned by the Nizām. The Pākhāl *shikārgāh* was abolished some years ago which led to a rapid felling and bringing under cultivation of some of the jungles, with a corresponding diminution of wild life. About four years ago the preserve was re-established. Though for all practical purposes the area is a sanctuary (H. E. H. himself is not keen on shooting, and the two elder princes generally shoot there only about once a year or so) it is doubtful whether with the exception, perhaps, of tiger, the reservation contains as much game as may be expected. The game-watchers that I came across when on ornithological survey work in this part of the country struck me—most of them—as thoroughly inefficient, and information supplied by them, wherever it could be tested, proved unreliable in nine cases out of ten. From my experience of these men (unfortunately the *Mūntazim* himself had died just a few days before my coming to Pākhāl) it is not inconceivable that a good deal of poaching is tolerated by them, either actively or through indifference or neglect. A proper enquiry alone can show if at the present time game is really in any better position here than elsewhere in the State forests, if indeed as much. Col. R. W. Burton informs me that in connection with the visit of a Viceroy in 1902 or thereabouts, Mr. Hankin, the then Inspector-General of Police, and Mr. Biscoe, Conservator of Forests, went through the Pākhāl country on purpose to see what game there was. They told him afterwards that they had seen *no* 'animal', and only one peafowl!

Depletion of Game Animals.

Inspite of the measures promulgated for the protection and preservation of the fauna, which theoretically speaking should give adequate protection to the existing species, Hyderābād unfortunately is no longer the prolific game country it was during the last century, and even during the past thirty years there has been a steady and perceptible diminution. The chief causes of the decline will be analysed later; in the meantime it is interesting to collate the present conditions with whatever little information we can gather concerning the recent past. In the middle of last century the country between Hingoli and Bōkar (Nāndēr District, Western Circle) was famous for tiger and Col. Nightingale shot many of his animals there. In two seasons (March-April) 1897 and 1899, Brigadier-General R. G. Burton of the then Hyderābād Contingent, killed twenty-six tigers in Sirpūr-Tandūr, mostly round Jangāon—the present Āsifābād. On his last visit to this district in 1899 he still found tigers as numerous as ever, and heard fifteen years later that they were just as abundant.

He always thought there was a great breeding-ground of tigers in the stretch of Hyderābād territory south of the Peinganga River in the Bēla and Rājūra talukas of the Sirpūr-Tandūr District and sees no reason why it should not now be as full of tiger as it was thirty-five years ago. Whatever the reason, those conversant with modern conditions in Hyderābād will agree that this is unfortunately not the case. The Ajanta Range all along the Khāndēsh border north of Aurangābād to Kannad was also famous for tiger in the early part of the last century, but now merely harbours occasional stragglers.

There were a few herds of gaur in Sirpūr-Tandūr in the 1890's. One whole herd was reported to have perished from foot-and-mouth disease at Mānikgarh. These animals are now very scarce, and though I often heard of their occurrence, I actually saw only one pair at Utnoor, and from the footmarks I came across in that part of the country they were obviously rare. Inspite, however, of the total prohibition of the killing of these bovines, I came across more persons than one who boastfully claimed to have shot them in recent years!

As regards cheetal, General Burton says: 'In days when cheetal were in vast numbers in the Kinwat (now I think called the Peinganga Reserve) there were scarcely any in adjoining Hyderābād territory across the river. The same with regard to antelope of which there were vast herds in Berār, but few over the Nizām's border.' It appears therefore that the mischief had already made good progress by the time of which General Burton writes.

Jerdon, in the first quarter of the last century, referred to herds of thousands of black buck in the country around Jālna. According to Col. R. W. Burton there were in 1897-1903 black buck and chinkara along the railway line between Secunderābād and Manmād, but fast being wiped out. In 1892 he saw herds of many hundred black buck when marching through the country. In 1903 these herds had dwindled to a dozen to twenty, not more. Though still fairly plentiful in some of the remoter parts of the Mahrattwāda districts, black buck are fast disappearing with the advance of colonisation and increasing facilities of swift transport, coupled with a complete disregard on the part of the man with the gun for age, sex or season. Herds of more than a few individuals are now uncommon, and heads of any decent size difficult to find.

General Burton says that in 1895-1899 there was plenty of feathered game in Hyderābād—Grey and Painted Partridge and Sandgrouse. This is now in a particularly bad way and needs speedy and drastic measures to restore it to anything like its former abundance.

My work in connection with the recent Hyderābād Ornithological Survey (1931-32) took me to many parts of the country once famous for game, and I made a point of investigating as far as possible into the present state of affairs. On the whole, it seemed to me that compared with accounts of even as recently as thirty years ago, the condition is distinctly poor, and this conclusion has since been confirmed by the State Inspector-General of Forests. It is true that tigers are still plentiful in certain portions of the Godāvari Forest Belt, but a rapid diminution in their numbers is inevitable if the present attitude of apathy is persisted in and things allowed to drift as now. Moving about the country as a non-official outsider, I had many opportunities of entering into conversation with people in every walk of life from whom much useful information could be gleaned concerning the subject. Moreover, once their initial suspicion was allayed and they perceived that my interest was chiefly confined to collecting birds, they came out with a good deal more about their exploits with the larger game animals than it would have been possible to extract by direct cross-examination. All I had usually to do was to lead them up to a point and leave them to damn themselves! Even after due allowance for bravado and for shikari's tales, the magnitude of the wanton destruction of life that goes on everywhere, was manifest.

What struck me as curious was that inspite of the formalities and obstacles in the way of getting shooting licenses and the limits of bags, as prescribed under the Regulations,[1] almost every man possessing a gun boasted of the number of tiger, sambhur, cheetal, often gaur and other game he had shot and was still continuing to shoot! The more discoursive ones could, with sufficient encouragement, usually be made to reveal the objectionable methods they employed, which they often did not unmixed with a certain measure of pride in their achievements. In the course of my wanderings in the forest at Nelipāka (in the Pāloncha Samastān), Amrābād, Ūtnoor and elsewhere, I constantly came upon machāns built on trees or pits dug round the edges of swamps or pools in nullah-beds, etc., from whose concealment these relentless gunners slaughtered every animal that came to drink, regardless of the season or whether it was male, female or young. The pity of it is that in many cases this destruction is made possible not only by a passive connivance of the petty officials who have a share in the spoils, but often with their direct abetment. A petty police, revenue or forest official who hears guns popping off almost every night close to his village even in seasons when there are no crops to justify them, can usually be induced to 'keep the peace' if he receives a leg of venison as hush-money. I say this with first-hand knowledge, and it is a fact known well enough to many of the higher officials with whom I had occasion to discuss the question, but who are powerless to put a stop to the practice under prevailing conditions. Sambhur and cheetal are perhaps the worst sufferers, and in areas where they were plentiful as recently as 10 years ago, a marked decline in their numbers is noticeable.

It is sad, but nevertheless true, that some of the greatest offenders are not the ignorant ryot and the village shikari, but directly or indirectly they are people like vakils, officials (usually, but not always, petty!) and well-to-do and so-called educated citizens who should know better. They either do the slaughtering themselves, regardless of Regulations and time of year, or lend out their guns to professional shikaris, or encourage the latter indirectly by commissioning them to procure game for them or by readily buying up whatever is offered for sale at all times of the year.

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[1] Clause 21 even says ' application from non-officials will be entertained but this I understand is now obsolete.

This indirect sort of abetment is not confined to four-footed game, but applies largely also to game birds such as partridge and quail. While on survey work on the outskirts of Aurangabad town in the second half of April (1932), I came upon a party of professional snarers complete with paraphernalia and decoy birds. Investigation showed that these men had been commissioned to catch bush-quails for a dinner being given the next day by a military 'Burra Saheb' of the British Cantonments! These professional snarers—Pardis and others—are veritable pests, but it is only thus that they are able to carry on their nefarious operations year in, year out, with the result that in many areas feathered game has been reduced to the verge of extinction. In the words of a highly-placed police officer who was also a keen sportsman and Nature-lover and strived at all times to ensure an observance of the Game Regulations, 'The man with the gun does not do half so much damage (to feathered game) as the snarer. He is like a broom, for he sweeps everything before him into his net.'

Principal Reasons for Depletion of Game.

Some of the causes contributory to the rapid and steady depletion of wild life in the Hyderābād State have been hinted at above. Many of them are the same as obtaining in other parts of India, but there are others which are peculiar to the Dominions and the direct outcome of conditions there prevailing. To tabulate them all, they are as follows:

1. Enormous and continued increase of population in the last two decades as shown by the Census Reports of 1921 and 1931.
2. Improvement, extension and opening up of new roads and railway lines (cf. the Kazipet-Belharsha line and others) and the introduction and penetration of motor cars and buses, which combined with (1), are having the effect of throwing open large tracts of country that hitherto provided a refuge to wild life.
3. The facilities provided by (2) in bringing distant game tracts within speedy and comfortable reach of the man with the gun.

I remember that in October 1925, just after the monsoon, it took me three days by bullock-cart to reach Ūtnoor from Nīrmal. There was no road most of the way and the journey had to be done over cart tracks little better than boulder-strewn ravines, and through swollen streams with rocky beds and steep muddy banks in which the wheels sank to the axle-trees. It was an experience not to be repeated in a hurry, however keen a shikari one might be. With the opening up of the Hatnūr-Ūtnoor road, off the main Nīrmal-Ādilābād road, the same journey was performed in 1932 by motor car in about as many hours! As Ūtnoor lies in the midst of some of the finest shooting country, the effect of this innovation on game can be imagined.

In the exploits of veteran shikaris of the 1890's, like General Burton, one constantly comes across names of places in the State like Jangāon (now Āsifābād) which it took him days of riding or marching to reach, and with an infinite amount of bandobast for his kit. The place is now accessible by rail and bus within a fraction of the time, and with no more bandobast than the purchasing of one's ticket!

4. Shooting from motor cars and buses both by day and by night is a growing menace. The practice has assumed alarming proportions since the Game Regulations were promulgated in 1914, and since it is apparently not contrary to law, it is freely indulged in by all and sundry.

5. The non-existence hitherto of the Arms Act and the easy availability of cheap guns of foreign and local manufacture, and of gunpowder and percussion caps for muzzle-loaders.

6. Indiscriminate poaching and slaughter of game for commercial purposes at all times of the year.

7. Wholesale snaring, netting and trapping of game birds such as partridge and quail, often at all seasons, and the taking of their eggs.

8. Droughts and epidemics.

9. Wild Dogs.

Remedies Suggested.

1, 2, 3. Increase of population, clearance of forest lands, extension of cultivation and of transport facilities are the natural concomitant of progress, and it would be unreasonable to check these, except perhaps (1), for which suggestions are out of place here! No case can be made out for protection of wild life at the expense of human interests. However, a strict observance of the Game Regulations in such areas should be enforced and punishments of a deterrent nature meted out to offenders uniformly, regardless of rank or social position.

4. Shooting from cars and buses, especially by night with the aid of powerful headlights and electric torches, should be made unlawful.

5. The recent introduction of the Arms Act into the State has not been a day too early. The restriction it will impose on the possession of firearms and on the purchase of ammunition, gunpowder and percussion caps should, if properly enforced, have a beneficial effect on wild life in course of time.

6 and 7. It is a fact that most of the poaching—slaughtering and snaring—is done for monetary gain and is encouraged directly or indirectly by people who have no excuse for pleading ignorance of the law. It is an axiom that if there were no receivers of stolen property there would be no thefts committed which, in the main, is unassailable. Therefore, if the promiscuous *purchase* of the meat, hides and horns of game animals (except perhaps of game birds in season under a regulated system) was made illegal,

as well as the *sale* of these articles, the chief incentive to poaching would be eliminated and a great deal of professional poaching would disappear. I suggest that as regards partridge and quail, areas should be set apart in rotation to remain entirely closed to *snaring* and *trapping* at all seasons, until such time as they become sufficiently replenished. The taking of eggs of all game birds should be made punishable.

8. *Droughts* can be remedied to some extent by the provision of reservoirs and by means of canals and channels leading from them. This has already been partly achieved in certain areas, cf. Pākhāl and Nizāmsāgar Lakes, and others. In times of drought, such places tend to draw round them animals from distant parts and, wherever possible, adequate forest land should be set apart near such reservoirs to provide harbourage to wild life at ordinary times, and specially in seasons of water famine.

Epidemics.

According to the Inspector-General of Forests, no epidemics among wild animals are reported, and no measures are taken to protect game in the forest against them. That measures are called for, however, is patent; an instance has been given above of a whole herd of bison being exterminated by foot-and-mouth disease near Mānikgarh and the late Mr. E. Ogilvie, a District Superintendent of Police, informed me that some years ago hundreds of animals perished in the Warangal District in a similar epidemic.

Large tracts of game country have been known to be cleared by rinderpest and foot-and-mouth disease contracted from infected cattle left to graze in forests inhabited by wild animals. Measures should be enforced that as soon as the first signs of an outbreak of these epidemics are detected in village cattle, they should be prevented from being let loose in Government forests containing game. One epidemic of this sort, as is well known, will do damage from which it will be difficult for game to regain its position for years afterwards. Often the damage is irreparable, and in many cases the serious diminution, or even complete extinction, of bison and buffalo in certain areas can be traced directly to disease contracted in this way from domestic cattle.

9. *Wild Dogs* do considerable damage to game, and inspite of a recent suggestion that their ravages have been over-estimated, it cannot be denied that measures devised to reduce their numbers in certain other Indian States and Provinces resulted manifestly in a corresponding increase of such animals as sambhur and cheetal which are their favourite prey. It may be a fact that they actually drive away more game than they kill, but it is none the less true that they do considerable slaughter. Moreover, the game thus driven out often suffers heavily in an indirect way by being forcibly exposed to other dangers perhaps just as great, if not greater. It may, for instance, be driven from its forest fastnesses to the neighbourhood of villages and cultivation, where it stands a good chance of falling to the gun of the village shikari or poacher, or in the case of young animals, to his dogs.

When I was at Āsifābād, the surrounding country was overrun by wild dogs, in consequence of which forests said to contain a fair amount of game ordinarily, were bare. I shot a wild dog which was later sent with the shikari to the kutcheri for claiming the prescribed reward. The Tahsildar was wholly unaware of any reward having to be paid! Enquiries of the Inspector-General of Forests elicited that some years ago rewards were paid for killing wild dogs (as per Clause 42 of the Game Regulations) but due to disuse this had become a dead letter and no rewards were now being paid. In my opinion, no case has been made out for the discontinuance of the rewards and the sooner they are reinstated the better.

The existing Game Regulations, with perhaps a few alterations and additions, are sound enough on paper. Their application and enforcement is quite another matter. Mr. Hankin, a former Inspector-General of Police, tried his best during many years, but though a forceful and able officer, it is doubtful if he was able to effect much. Neither have the authorities at the top relaxed their efforts since, but for all practical purposes the position has not improved. In my opinion the immediate way of dealing with the problem as far as the State is concerned, would be to form a small committee comprised of a competent non-official sportsman and naturalist, and Forest, Police and Revenue interests to go into the matter thoroughly and *de novo*, and to investigate the exact present position of wild life from district to district. Having once determined this, and with due regard to the varying conditions, they should be able to devise practicable measures for giving effect to the remedies suggested above and to any others that may seem to them necessary.

There are extensive tracts of forest in the State which might be demarcated and set apart as Wild Life Sanctuaries on the model of the National Parks now in existence in most civilised countries of the West. Three suitable localities suggested by the Inspector-General of Forests for such reservtaion are: (1) along the cart track from Āsifābād to Ūtnoor-Ādilābād District; (2) Amrābād-Mahbūbnagar District; (3) around the newly constructed Nizāmsāgar Lake—Mēdak District. For the administration of these reservations and also for a proper administration of the Game Regulations in other State forests, the need of creating a separate and efficient Game Department becomes imperative. This should consist of a Game Warden with a staff of assistants, and watchers of the right type. It should either be subject to the Inspector-General of Forests and work in full co-operation with his department, or better still be directed by a small committee consisting of the Inspector-General of Forests, the Inspector-General of Police, the Revenue Member and the Game Warden (*ex-officio*). By a curious anachronism, shooting licenses are at present issued by the Political Department. Whatever may have been the origin and desirability of this practice in the past, it is clear that the function should now be transferred to the Forest Department where it rightly belongs. Later it could be taken over by the Game Department. The present procedure has little to recommend it; it results in unnecessary inconvenience and lack of co-ordination which does not make for efficiency.

After a proper investigation into the problem of wild life conservation in the Nizām's Dominions, as elsewhere, it emerges more clearly than ever that at the back of all the senseless slaughter and law-breaking, which has brought about the present sorry plight, is the apathy of public opinion towards the need for the preservation of our fauna. The backing of public opinion is vital to the success of a campaign of this nature. Lectures and the exhibition of suitable cinema films should be organised in order to rouse the public from its apathy and make it realise the value and importance of wild life, and appreciate the measures and the arguments put forward for its protection and preservation. A beginning must also be made with children in the schools, by means of properly arranged Nature Study programmes, so that they will grow up to a love of Nature Study programmes, so that responsibility for the conservation of wild life which is their natural heritage. Let us hope it will not be too late before the necessary steps are taken by the authorities.

I am indebted for much interesting information concerning game in the Hyderābād State in the recent past to the two veteran sportsmen brothers Brigadier-General R. G. and Col. R. W. Burton, and to Nawāb Hāmid Yār Jung Bahādūr, the State Inspector-General of Forests, for his ready and willing co-operation in supplying me with a great deal of authentic data relating to modern conditions and to the existing Game Regulations and their administration in the Dominions.

DEHRA DUN,
30th September, 1933.

No. 9. MYSORE.

BY

Major E. G. Phythian-Adams, F.Z.S.

The State of Mysore is an elevated table-land varying in altitude for the most part from 2,500 to 3,000 ft. above sea-level. The Western Ghats rising to some 5,000 ft. bound it on the west and break the force of the South-West Monsoon. On the south are the Nilgiri Hills and on the south-east the Billigirirangans, the highest point of which is about 5,000 ft. above sea-level. In the interior the country is undulating and in many parts hilly. Generally speaking the northern part of the State consists of open plains with occasional rocky hills, the centre is the most intensely cultivated, while on the western and southern fringes are the denser forests. The total area of the State is some 30,000 sq. miles of which forests cover over one-tenth. The forests are divided into: (1) Game Preserves which are closed to all shooting and fishing except by special permission; (2) State forests corresponding to Reserved forests in British India where the pursuit of game is illegal except on licence; and (3) District forests which now hold little but small game, panthers and wild pig.

Mysore is the fortunate possessor of a fauna so diverse and varied that few other parts of India can equal it. The extensive open plains of the north are the home of numerous herds of black buck, which extend more or less over all cultivated areas of the State; the more broken country holds chinkara and wolves, while nilgai though uncommon are still reported to exist in certain parts. The forests contain herds of elephant and bison, and a good herd of sambhur and spotted deer, while lesser fry, barking deer, wild pig, etc. are common in suitable localities. The State contains some famous tiger grounds and panthers are ubiquitous, though hunting leopards are probably now extinct. Bears are fairly common in certain parts and wild dogs even more so. The list of indigenous small game includes the Great Indian Bustard, Florican, Peafowl, Jungle and Spurfowl, Partridge, Sandgrouse (two or more varieties), several species of Quail, Green, Bluerock and Imperial Pigeons, and the Indian Hare, to which must be added in the cold weather countless numbers of Snipe, Duck and Teal and some Bar-headed Geese, which find rich subsistence in the paddy fields and on the irrigation tanks with which the State is so well provided. Apart from game birds Mysore is particularly rich in bird life both resident and migrant, and it is to be hoped that before long a regular scientific survey of it will be carried out as has been already done in other parts of South India.

The principal rivers of the State are the Cauvery and Kabbany, and on the northern border the Tungabhadra, and there are numerous subsidiary streams, all of them holding the snub-nosed crocodile and immense numbers of fish: mahseer, carp, murrel, labeo, etc. providing not only excellent sport but also an important item of food supply to the population.

The above short survey will show how varied the Fauna is, and it now remains to compare the past with the present, to consider the Game Laws, and to make any suggestions for further safeguarding an asset of such importance.

For information about wild life in the State in years gone by we are largely dependent on the well-known works of Sanderson and other sportsmen. In those days there were apparently no game preserves and one gathers, no game laws either. Big and small game of all kinds was plentiful and the bags obtained were certainly larger than would be possible now. But already by 1900 a distinct decrease was noticeable for Russell writing in that year remarks that: 'One has only to read old sporting books and even so comparatively recent a one as Mr. Sanderson's and to know the forests as they are at this day, to fully appreciate the terrible rate at which game has decreased and is ever decreasing in Mysore'; and personal enquiries from older residents in the State confirm a great decrease of big game in the District forests, and to a lesser degree in the State forests, though the position in the Game Preserves is less unfavourable.

Due consideration must however be given to the inevitable restrictions imposed on wild life by the opening up of fresh areas to cultivation, the increase of population and consequent increased number of arms licences, and improved communications and means of transport, and if all these are taken into account, it would be unreasonable to consider the present position as unsatisfactory, though certain steps are most desirable to prevent further deterioration.

Elephants which are strictly protected as in British India continue to provide sufficient numbers for the famous kheddahs as and when required. There is no dearth of bison and good heads are still obtainable. Sambhur and spotted deer are still to be found in fair numbers. Black buck which in some parts were certainly in danger of extermination before the War have now largely recovered, thanks to protection. Tigers are as numerous as ever in Shimoga and Bandipur though they appear to have deserted Sanderson's old shooting grounds on the south-eastern border, probably owing to all the deer there having been killed off. Panthers continue to be as much a pest as ever. Wild dogs are certainly not on the decrease in spite of the reward placed on their destruction. Bears seem to have changed their habits to some extent and to have become more nocturnal than in Sanderson's time, but though harder to find they certainly exist in fair numbers. Wolves certainly have decreased, which will not be regretted by sheep owners whose herds used to suffer severely from their depredations. Up to about 1914 a few were shot almost every year close to the capital but a careful search in recent years has failed to discover their existence within many miles of the city. Turning to birds the only resident which has seriously decreased is the Great Indian Bustard. A few pairs still exist in favoured localities in the centre of the State, their numbers slightly increasing as one goes north, but at the best there are very few left and their survival if left longer without protection is most unlikely. Great numbers of partridges and junglefowl are snared and sold in the towns throughout the year and this unrestricted slaughter is already having its effect though there is little fear of their extermination at present. Of the migratory birds duck and teal have certainly greatly decreased in numbers during the past ten years but this is a matter hardly within the control of the State authorities though some improvement might be effected in the case of the spotbill duck and whistling teal numbers of which stay to breed locally, were the trade in their eggs made illicit. The shooting of Demoiselle cranes might well be prohibited in certain areas where their pursuit offends the religious prejudices of the inhabitants. Their numbers are so vast that there is little fear of their being seriously reduced, but protection seems desirable for the reason given, as more than one fracas has already occurred in this connection.

So far as is known the only attempt to introduce exotic fauna was the importation of a herd of fallow deer a few years back, but unfortunately the experiment failed as they were quickly killed off by wild dogs. There should however be less difficulty in introducing gooral which could be obtained without much trouble from the lower Himalayas and for which an ideal locality could be found in the isolated Gopalswamibetta hill. Such an addition to the fauna would be of great interest as at present this species is unknown in South India.

The Game Laws of the State were revised in 1931 and on paper serve as a model of their kind. In general they follow those in force in the Nilgiris and other parts of British India, but there are two important clauses which strike a new note in Game Preservation in India, viz.: (1) classification of tigers as 'game' with an annual bag limit of two; and (2) imposing on private owners the necessity for taking out a licence before they can shoot game on their own land. The damage done by tigers is often much exaggerated and the help which they give to the ryot by destroying deer and pig forgotten, and the Mysore Government deserves great credit for its bold step in giving them some form of protection, an example which might well be followed in other parts of India. The clause regarding private lands is of course on the lines in force in Great Britain and as such is a distinct advance, though it might have made clear the inalienable right of the owner to game on private land, a most important point which seems to have been overlooked in other parts of India also, as the private owner can do so much to protect the wild life on his land if educated to do so.

A noticeable omission from the Laws is any clause dealing with that modern pest the motor car shooter. Shooting from cars is indefensible; it is not sport but slaughter, and far too many animals escape to die a lingering death. It has been very rightly banned in East Africa with severe penalties, and recently we understand in the Bombay Presidency and in the Nilgiris, and

Mysore which justly prides itself on being an advanced State would do well to follow this good example. At present the practice is on the increase, and one hears almost incredible stories of bursts of rapid fire at herds of bison, of animals shot and left to rot by the roadside, and of lorries specially equipped with spotlights for poaching sambhur etc. at night. No shooting should be permitted within 100 yards of a car, and heavy penalties enforced for breach of this rule.

As has been said above, the existing Game Laws are a model of their kind, but as has been found in other parts of India, it is one thing to pass a law and quite another to enforce it. The public generally and many even of the subordinate officials appear to have no knowledge of the existence of these laws, far less of their provisions, and poaching is widespread and largely unchecked. Public opinion is not yet sufficiently educated to realise the importance of the preservation of the fauna, and until the scope and purpose of the Game Laws are more widely known, it cannot be expected that their provisions will be generally observed. Much good would be effected if the subordinate Government officials of all Departments concerned were made to realise their responsibility in the matter, and this applies with particular force to the Forest Range Officers who if they like can put a definite stop to all poaching.

But still more important is the education of public opinion which can best be effected by propaganda in the Press, by lectures and nature classes in schools and colleges, by the formation of local associations for the study and protection of wild life, and by collaboration with similar societies already existing in other parts of India.

Equally important is the creation of a Wild Life Fund to which would be credited all revenue from arms licences, shooting and fishing licence fees, fines for offences, etc. while the Fund would be used to pay rewards for the destruction of vermin, for preventing poaching, and for the upkeep of a Game Warden and National Park. At present there are in the State no sanctuaries for wild life, though to a certain extent the Game Preserves take their place, but a stricter supervision is required if these are to fulfil a really useful purpose. It is suggested that part of the Bandipur Game Preserve might with advantage be turned into a National Park. This area holds a good head of game and wild life generally, and being adjacent to the strictly preserved Mudumalai forest under control of the N.G.A. could be easily policed. Bandipur lies on the main road some 50 miles equidistant from Ootacamund and Mysore City, and a well organised Park there should prove a great attraction. The existing Travellers' Bungalow could be easily enlarged to provide the necessary accommodation.

There is no doubt that the presence of sportsmen in shooting areas is one of the greatest curbs on the activities of the poacher, and more encouragement should be given them by reducing licence fees which are at present excessive in comparison with the bag obtainable and by throwing open to the general public some at any rate of the Game Preserves.

Legislation is also required to prevent the sale of game in the close season; this would considerably restrict the activities of the motor poacher who shoots solely for gain.

To sum up, the present position of wild life in Mysore is, considering all the factors involved, not unsatisfactory; but this position will certainly deteriorate seriously in the near future unless steps are taken to prevent it, in which connection the following are suggested as most important:

(1) Strict enforcement of the existing Game Laws;
(2) Education of public opinion in every possible way;
(3) Formation of a Wild Life Fund;
(4) Prohibition of all motor car shooting;
(5) Prohibition of sale of game out of season and control of traffic in hides and horns;
(6) Protection for the Great Indian Bustard;
(7) Encouragement of genuine sportsmen; and
(8) Establishment of a National Park.

Mysore has been blessed by Nature with an unusually rich fauna, and every possible step should be taken in time to safeguard it and to make its people realise the importance from every point of view of such a national asset.

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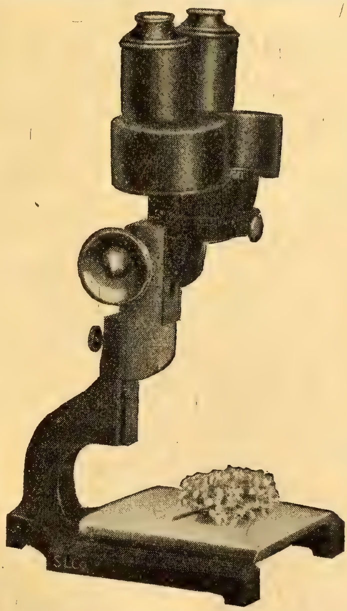

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